ONTARIO DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

SUMMARY OF FIELD WORK, 1971
by the
GEOLOGICAL BRANCH

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Edited by
E.G. Pye

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1971

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SUMMARY OF FIELD WORK, 1971

by the

GEOLOGICAL BRANCH

ONTARIO DEPARTMENT OF MINES AND NORTHERN AFFAIRS

INTRODUCTION

by

E.G. Pye[1]

In 1971 the Geological Branch of the Ontario Department of Mines and Northern Affairs placed 30 geological survey parties, 1 geochemical survey party, and 1 geophysical survey party, in the field. This involved the services of 149 persons who worked on 33 different projects. Most projects were under the direction of members of the Geological Surveys Section. Seven were conducted by members of the Industrial Minerals Section, and one by a member of the Resident Geologists' Section.

The locations of the areas investigated during the field season are shown on the map of the Province, Figure 1, page 2. The results of the work are outlined in this summary, which contains reports prepared by each of the project leaders. In the reports, emphasis has been placed on the economic aspects of the different investigations. It is the hope of the Geological Branch that the information thus provided will help in the selection of favourable areas for prospecting and so will be a valuable aid to mineral exploration in the Province.

Coloured maps and final detailed reports covering most of the field projects are being prepared for publication. In the interim, however, uncoloured preliminary geological maps with comprehensive marginal notes, will be released for distribution mostly during the winter of 1971-1972. These will be published at the field scale of 1 inch to 1/4 mile, 1 inch to 1 mile, or 1 inch to 2 miles. Notices of the releases will be mailed to all persons or organizations on the Ontario Department of Mines and Northern Affairs notification list, and will be published in the technical journals and other media.

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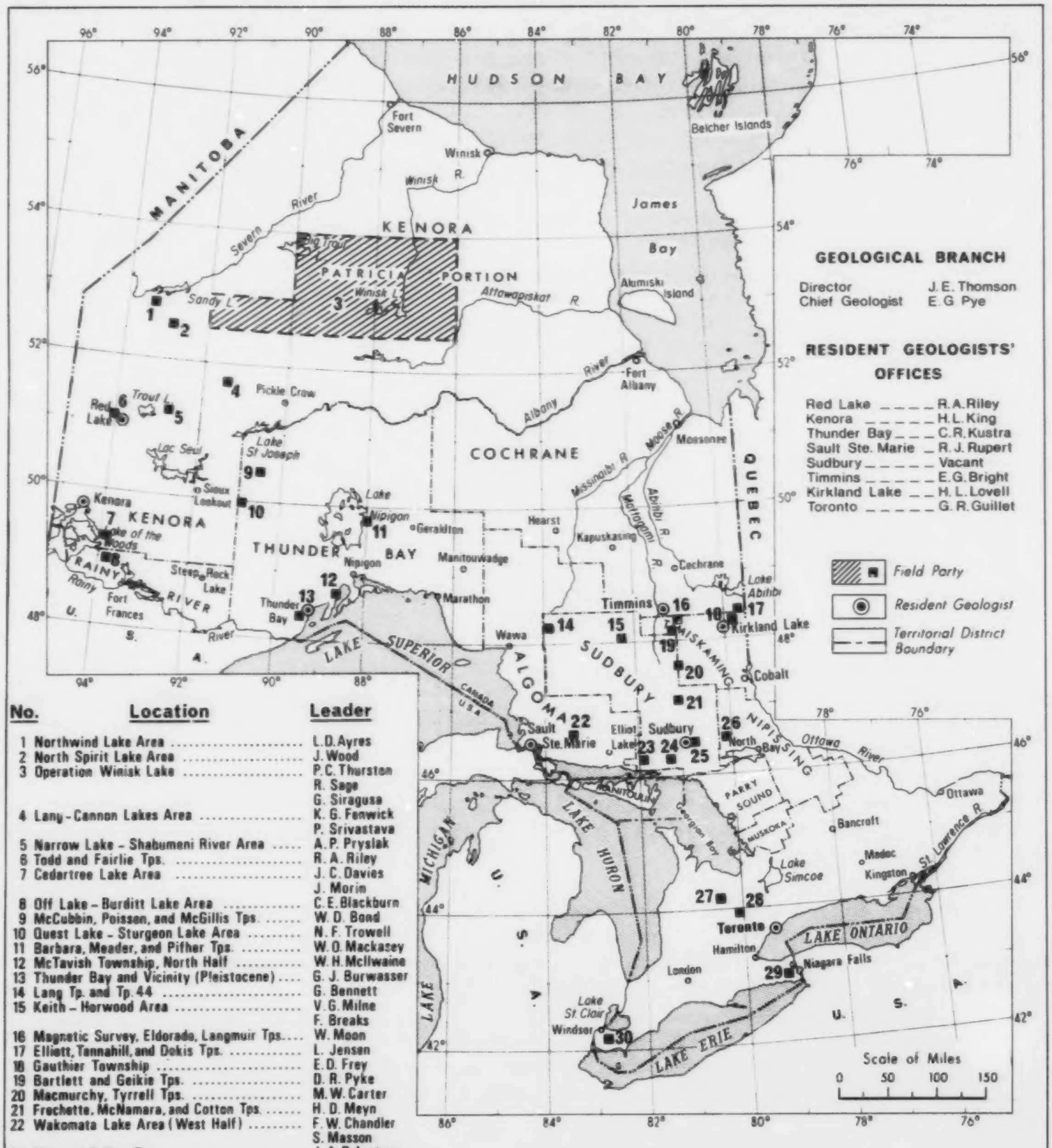
HUDSON BAY
James Bay
MANITOBA
QUEBEC
KENORA PATRICIA PORTION
KENORA
THUNDER BAY
COCHRANE
ALGOMA
SUDBURY
TIMISKAMING
NIPISSING
PARRY SOUND
MUSKOKA
RAINY RIVER
LAKE SUPERIOR
LAKE HURON
LAKE MICHIGAN
LAKE ONTARIO
LAKE ERIE
U.S.A.
Field Party
Resident Geologist
Territorial District Boundary
Scale of Miles
0 50 100 150

GEOLOGICAL BRANCH

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Chief Geologist	E. G. Pye

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Red Lake	R. A. Riley
Kenora	H. L. King
Thunder Bay	C. R. Kustra
Sault Ste. Marie	R. J. Rupert
Sudbury	Vacant
Timmins	E. G. Bright
Kirkland Lake	H. L. Lovell
Toronto	G. R. Guillet

No.	Location	Leader
1	Northwind Lake Area	L. D. Ayres
2	North Spirit Lake Area	J. Wood
3	Operation Winisk Lake	P. C. Thurston R. Sage G. Siragusa
4	Lang-Cannon Lakes Area	K. G. Fenwick P. Srivastava
5	Narrow Lake - Shabumeni River Area	A. P. Pryslak
6	Todd and Fairlie Tps.	R. A. Riley
7	Cedartree Lake Area	J. C. Davies J. Morin
8	Off Lake - Burditt Lake Area	C. E. Blackburn
9	McCubbin, Poisson, and McGillis Tps.	W. D. Bond
10	Quest Lake - Sturgeon Lake Area	N. F. Trowell
11	Barbara, Meader, and Pifher Tps.	W. O. Mackasey
12	McTavish Township, North Half	W. H. McIlwaine
13	Thunder Bay and Vicinity (Pleistocene)	G. J. Burwasser
14	Lang Tp. and Tp. 44	G. Bennett
15	Keith - Horwood Area	V. G. Milne F. Breaks
16	Magnetic Survey, Eldorado, Langmuir Tps.	W. Moon
17	Elliott, Tannahill, and Dokis Tps.	L. Jensen
18	Gauthier Township	E. D. Frey
19	Bartlett and Geikie Tps.	D. R. Pyke
20	Macmurchy, Tyrrell Tps.	M. W. Carter
21	Frechette, McNamara, and Cotton Tps.	H. D. Meyn
22	Wakomata Lake Area (West Half)	F. W. Chandler S. Masson
23	May and Hallam Tps.	J. A. Robertson K. Siemiatkowska
24	Panache Lake Area	K. D. Card D. S Innes
25	Sudbury Area (Pleistocene)	G. J. Burwasser
26	River Valley Area	S. B. Lumbers
27	Dundalk Area (Pleistocene)	O. H. J. Gwyn
28	Orangeville Area (Pleistocene)	W. R. Cowan
29	Niagara - Welland Area (Pleistocene)	B. H. Feenstra
30	Windsor - Essex Area (Pleistocene)	U. J. Vagners
31	Magnetic Base Stations	W. Moon
32	Industrial Mineral Studies, Southern Ontario	M. A. Vos
33	Geochemical Surveys, Northern Ontario	W. J. Wolfe

LOCATION OF FIELD PARTIES, 1971

GEOLOGICAL BRANCH

ONTARIO DEPARTMENT OF MINES AND NORTHERN AFFAIRS

ODMNA 4714, MP49

No. 1 NORTHWIND LAKE AREA

DISTRICT OF KENORA (PATRICIA PORTION)

by

L.D. Ayres[1]

Location: Mapping of the Northwind Lake area, begun in 1970 (Ayres 1970b), was completed and several mineral showings in the adjoining Setting Net Lake area (Ayres 1970a) were mapped in detail. The map-area is bounded by latitudes 52°41' and 52°51'N and by longitudes 93°22' and 93°34'W and covers the southeastern part of the Favourable Lake metavolcanic-metasedimentary belt in northwestern Ontario. Previous mapping to the north and west is shown on Ontario Department of Mines Preliminary Geological Maps P.422, P.439, and P.538. The area is about 120 miles north of Red Lake and access is by float-equipped aircraft.

Mineral Exploration: Recorded mineral exploration of the Favourable Lake belt began in 1927 and the belt is now known to contain molybdenum, gold, silver, lead, zinc, copper, iron, asbestos, uranium, and thorium mineralization. Anomalous features of the belt are: (1) high concentration of molybdenum; (2) high silver:gold ratios in many precious metal occurrences. The only mineral production from the belt came from the Berens River Mine, now held by Ducanex Resources Limited under option from Golsil Mines Limited. This property is three miles west of the map-area and from 1939 to 1948 it produced 157,341 ounces of gold, 5,676,486 ounces of silver, 6,105,872 pounds of lead, and 1,797,091 pounds of zinc from 560,707 tons of ore; value of production was $9,481,498 (Annual Reports, Berens River Mines Limited). During the field season, Ducanex Resources Limited did surface exploration on this property.

No exploration work was done in the map-area during the field season, but claim groups are currently held by Minorex Limited, Newconex Canadian Exploration Limited, K. Koleff, and the Keevil Mining Group Limited. Minorex Limited is the largest property holder with about 90 claims in several groups on which surface exploration was carried out in 1969 and 1970. Also in 1970 they made an airborne geophysical survey across most of the metavolcanic sequence in the map-area, and in the early part of 1971 they drilled four holes to test geophysical anomalies located by the survey.

Newconex Canadian Exploration Limited holds about 50 claims in two groups and carried out prospecting and geophysical surveys in 1969 and 1970.

Nine leased claims held by K. Koleff north of Setting Net Lake cover several copper showings. These showings have been tested by diamond drilling by three companies: Kega Gold Mines Limited (3,541 feet in 1944-1945), Peteque Mines Exploration Limited (627 feet in 1952), and Senet Copper Mines Limited (8,690 feet in 1956-1957).

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[1] Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

The Keevil Mining Group Limited holds about 60 claims in four groups covering radioactive anomalies in the granitic batholith south and east of Setting Net Lake; the claims are optioned from CAM Mines Limited. The anomalies are part of a west-northwest-trending radioactive zone extending from Favourable Lake to Whiteloon Lake. The western part of this zone was actively explored by the Keevil Mining Group Limited and CAM Mines Limited from 1967 to 1970.

General Geology: The map-area covers the southeastern end of a 7-mile wide, southeast-trending, Early Precambrian metavolcanic-metasedimentary belt that extends from Northwind Lake to west of the Ontario-Manitoba border. The belt is widest near Setting Net Lake, at the west boundary of the map-area, and gradually narrows northwestward; to the southeast it is terminated, near Northwind Lake, by a granitic batholith, but narrow metavolcanic "screens" extend several miles into the batholith. North of Northwind Lake a 1,000-foot wide, east-trending "screen" is at least 3 miles long and extends beyond the east boundary of the area. Two narrow, southeast-trending metavolcanic belts are in the southern batholith south of the main belt (Ayres 1970b).

The main belt is composed largely of a complex metavolcanic sequence containing local intercalations of clastic and chemically precipitated metasediments in the upper part. The metavolcanic sequence comprises a lower intermediate to felsic formation and an upper mafic flow sequence that contains several thick tongues and lentils of felsic to intermediate flows and pyroclastic rocks. The upper sequence and associated metasediments were mapped in 1970 and were described previously (Ayres 1970b).

The intermediate to felsic formation forms most of the metavolcanic sequence in the area and is at least 10,000 feet thick. It consists of about 45 percent intermediate flows that are partly amygdaloidal and porphyritic, 40 percent intermediate lapilli-tuff and tuff, and 15 percent felsic tuff, lapilli-tuff, and amygdaloidal flows. Felsic units are up to 1,500 feet thick and are concentrated near Twinpeaka Lake in the northern part of the area.

Metamorphosed minor intrusions ranging in composition from ultramafic to felsic cut the metavolcanic sequence and are probably related to volcanism. Metagabbro and metadiorite dikes, sills, and small stocks are the most abundant of the minor intrusions and range in width from 1 foot to 1,500 feet, but are generally less than 50 feet wide. The dikes and sills have diverse trends and occur throughout the metavolcanic sequence, but are concentrated in a 4-square mile area south of Twinpeaka Lake where they form about 20 percent of the sequence. This may be near a volcanic centre. Serpentinized ultramafic rocks are locally present in the sequence and form narrow dikes, sills, and one small stock. Feldspar and quartz-feldspar porphyry dikes, sills, and a small stock intruded the metavolcanic sequence north of Setting Net Lake, but are sparse elsewhere except for two north-trending en echelon dikes up to 600 feet wide southeast of Twinpeaka Lake.

The metavolcanic sequence was intruded by two composite granitic batholiths that form the boundaries of the belt and underlie about 60 percent of the map-area. On the southwestern and northern sides of the belt, the batholiths are generally conformable to metavolcanic formations and contacts are sharp and relatively straight. On the southeastern side, however, the batholith cuts across stratigraphic units in the belt and the contact is irregular because of many granitic sills intruded into the metavolcanics and resultant migmatitic metavolcanic "screens" projecting southeastward into the batholith.

The batholiths are composed of at least ten discrete intrusive phases that form stocks, sills, dikes, and dike swarms ranging in composition from diorite to quartz monzonite. The older phases are generally mesocratic and hornblende-bearing whereas the younger phases are leucocratic, hornblende-free, biotitic rocks that are more potassic than the older phases. The batholiths are described in more detail on Ontario Department of Mines Preliminary Geological Maps P.439 and P.538.

Post-batholith intrusions comprise several lenticular syenite sills related to fault activity, one narrow diabase dike, several narrow ultramafic dikes, and one thin subhorizontal quartz diorite sheet.

Structural Geology: The metavolcanic sequence has been isoclinally folded with fold axes generally trending northwest parallel to the boundaries of the belt. The major structure is a gently northwest-plunging anticline.

Many faults have been recognized in the area and greatly hamper stratigraphic correlation. Three major fault systems predominate.
(1) East- to east-northeast-trending faults are in the northwestern part of the area and produce large stratigraphic displacements.
(2) Southeast- to south-southeast-trending faults with right-hand strike separation occur in the western part of the area and appear to merge southward with (3).
(3) Southeast- to east-southeast-trending faults in the southwest corner of the area have large vertical components of movement with the south side having moved up.

The east-southeast-trending fault system has been traced from Favourable Lake to MacDowell Lake and is a major structural boundary separating the Berens River Block or subprovince on the south from the Gods Lake Block (Wilson 1971) or subprovince on the north. Study of the granitic batholith through which the fault system passes indicates that there has probably been at least 2 miles of vertical displacement along the fault system. Small syenitic and ultramafic intrusions were emplaced along or near the fault zone.

Economic Geology: Mineral showings in the map-area contain copper, lead, zinc, gold, silver, molybdenum, and radioactive elements. In 1970, 15 chalcopyrite, 5 molybdenite, and 8 radioactive occurrences were mapped and have been previously described (Ayres 1970b). The present discussion will consider only those occurrences mapped in 1971 and new data on previously described showings in both the Northwind and Setting Net Lakes areas.

Fourteen chalcopyrite occurrences and one digenite ($Cu_{1.76-1.79}S$) occurrence were located in 1971; of these the most interesting seems to be the digenite occurrence, which is on crown land, 1 mile due south of the east end of Twinpeaka Lake. There is no evidence of any previous work on this showing. The digenite forms black, randomly oriented veins containing variable, but commonly minor amounts of brochantite ($Cu_4(SO_4)(OH)_6$), hematite, and quartz and ranging in width from a fraction of an inch to one inch. The veins fill closely spaced fractures in altered felsic to intermediate flows and associated tuff and were found in a 20-foot by 90-foot, north-trending zone at the east edge of an outcrop. The highest concentration of veins was in a 10-foot by 20-foot area at the southeast corner of the outcrop. Two grab samples containing thin digenite veinlets collected by the author from this latter area were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs and contained 1.41 and 1.60 percent copper and 0.16 to 0.20 ounces of silver per ton. Samples containing wider veins have a proportionally higher copper and silver content and a sample of a 1-inch wide, hematite-digenite vein collected by the author contained 60.2 percent copper and 1.21 ounces of silver per ton. The alteration in the country rock consists of thin, closely spaced, chlorite-actinolite veins and blebs and local garnet; the alteration seems to be spatially related to the mineralization and may have been metamorphosed. About 200 feet north of the main digenite area, the alteration zone is obliterated by a later (?) alteration zone associated with a major east-trending fault.

Chalcopyrite was found in the following environments: four showings in metagabbro, three of which are in quartz veins; four disseminated occurrences and three quartz veins in intermediate to felsic metavolcanics; three quartz veins in granitic rocks, one of which was previously described; and one showing in ferruginous chert.

A poorly exposed metagabbro sill along the north shore of Northwind Lake contains up to 15 percent disseminated pyrrhotite, pyrite, and minor chalcopyrite. Mineralization is intermittently exposed over an area about 20 feet wide and 50 feet long. A grab sample collected by the author and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.16 percent copper.

In two of the quartz vein occurrences in metagabbro, minor chalcopyrite occurs in narrow quartz veins with sparse chalcopyrite in the country rocks. Two grab samples collected by the author's assistant from these showings and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, each contained 0.16 percent copper with one vein also containing 0.1 percent tungsten.

The third quartz vein occurrence is a 1-foot wide, quartz-calcite vein trending N5W and dipping 20 degrees west near the north edge of an east-trending metagabbro dike. The vein contains trace to 30 percent pyrite and chalcopyrite and has been traced for 35 feet by a trench. It occurs on claims held by Minorex Limited, 2 miles west of Northwind Lake near the winter road between Northwind and Setting Net Lakes. Three grab samples collected by the author from the quartz part of this vein were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs,and were found to contain 0.89 to 13.2 percent copper, 0.01 to 0.08 ounces gold, and 0.17 to 2.70 ounces silver per ton. A grab sample from the calcite part of the vein contained 0.33 percent copper and traces of gold and silver.

Immediately north of the metagabbro sill and on strike with the quartz-calcite vein, the basal part of a thin porphyritic flow trending N10E and the upper part of the intermediate lapilli-tuff unit are silicified and contain trace to 5 percent disseminated pyrite and chalcopyrite. Seven grab samples collected by the author from both the flow and tuff and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.08 to 0.40 percent copper. The mineralized zone has been traced by pits for a length of 150 feet and is up to 10 feet wide.

Disseminated chalcopyrite was found about 1 mile west of Northwind Lake in a small area in altered intermediate metavolcanics adjacent to the major east-trending fault that is also close to the digenite showing. A grab sample collected by the author's assistant and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.21 percent copper.

Disseminated chalcopyrite was found in concordant epidotized zones in intermediate metavolcanics at two places near the outlet of Northwind Lake. The epidotized zones are up to several feet wide and consist of epidote, quartz, calcite, garnet, pyrite, and chalcopyrite; they seem to be metamorphosed volcanogenic alteration zones. Grab samples collected by the author from these occurrences were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, and contained 0.42 and 0.56 percent copper and 0.15 and 0.21 ounces silver per ton.

Narrow quartz veins and lenses occur throughout the intermediate to felsic metavolcanic formation and locally contain disseminated pyrite and chalcopyrite. Grab samples collected by the author's assistant from a 1-foot wide vein and a 1.5-foot wide vein were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, and contained 0.47 percent copper and 0.04 ounces gold per ton and 0.40 percent copper and 0.17 percent molybdenum respectively. The gold-bearing vein is 0.5 miles south of Twinpeaka Lake and the molybdenum-bearing vein is at the northwest corner of Northwind Lake on a claim held by Minorex Limited.

Narrow quartz-carbonate lenses containing disseminated pyrite and chalcopyrite occur in a narrow zone in intermediate lapilli-tuff adjacent to metagabbro 1.5 miles west of Northwind Lake. A grab sample collected from this zone by the author's assistant and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.28 percent copper.

Two chalcopyrite-bearing quartz veins occur in a porphyritic, hornblende-biotite trondhjemite unit north of Setting Net Lake; both showings have been trenched. The western (Young) showing is on leased claims held by K. Koleff and comprises several diversely oriented quartz veins and lenses up to 3 feet wide and 100 feet long. The veins contain up to 25 percent pyrite and 10 percent chalcopyrite as irregular veinlets and blebs. Thirteen grab samples collected by the author and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.01 to 2.51 percent copper, and traces of bismuth, lead, and zinc; gold and silver assays have not yet been completed.

The other showing (Ayres 1970b) is partly on crown land and partly on a claim held by Newconex Canadian Exploration Limited. It is 0.5 miles northeast of the Young showing and consists of several north- and east-northeast-trending quartz veins and lenses up to 5 feet wide. Mineralized veins have been found in an area about 50 feet wide and 500 feet long along the north edge of an outcrop. These veins contain variable amounts of pyrite, pyrrhotite, arsenopyrite, chalcopyrite, galena, and sphalerite. Three well-mineralized grab samples collected by the author's assistant in 1970 from the eastern part of the zone and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.02 to 0.52 percent copper, 0.47 to 1.36 percent lead, 0.05 to 1.52 percent zinc, 0.01 to 0.54 ounces gold, and 1.63 to 2.18 ounces silver per ton. Analyses on samples collected by the author in 1971 have not yet been completed. This showing has been tested by seven diamond drill holes that were probably put down by Kega Gold Mines Limited in 1944 or 1945.

A third copper-bearing quartz vein is in the granitic rocks on the west shore of Northwind Lake but is only three inches wide.

A 100-foot thick sulphide facies ferruginous chert unit known as the McCloskey showing occurs on leased claims held by K. Koleff north of Setting Net Lake. The chert contains veins and fine disseminations of pyrrhotite and narrow veinlets of chalcopyrite. Seven grab samples collected by the author and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained 0.03 to 0.52 percent copper and traces of silver, nickel, and zinc.

At the McCloskey showing and at many showings associated with sulphide facies ferruginous chert in the adjacent Setting Net Lake area (Ayres 1970a), the chert is underlain by highly altered mafic metavolcanic flows composed of epidote, quartz, diopside, garnet, pyrrhotite, pyrite, minor chalcopyrite, and locally calcite. The alteration zone ranges in thickness from a few feet to several tens of feet with the alteration increasing in intensity upward toward the chert. These zones seem to be metamorphosed fumarolic alteration zones that formed during chert deposition.

Other chalcopyrite showings in the Setting Net Lake area consist of a similar type of alteration zone but chert is absent and the altered flow is overlain by a relatively unaltered flow; zoning in the alteration zone can be used to determine the top of the flow. Alteration zones of both types are best developed at the Oliver showings (Hurst 1929; Ayres 1970a) east of Setting Net Lake and now held by Minorex Limited.

A third type of metamorphosed volcanogenic alteration zone which is both concordant and discordant to flow tops forms a wide zone in a mafic flow sequence east of Setting Net Lake (Ayres 1970a, Unit 1m). This zone contains sparse molybdenite and local concentrations of chalcopyrite and also seems to be fumarolic in origin and not tectonic as previously thought.

The presence of ubiquitous, although superficially minor, copper in both the alteration zones and associated chert warrants further investigation.

In the Northwind Lake area minor molybdenite was found in granitic rocks near the northwest corner of Northwind Lake. Molybdenite occurrences found in 1970 are also restricted to this area (Ayres 1970b).

Concentrations of pyrite and pyrrhotite, other than those associated with chalcopyrite, were found only rarely in the metavolcanic sequence.

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No. 2 NORTH SPIRIT LAKE AREA

DISTRICT OF KENORA (PATRICIA PORTION)

by

J. Wood[1]

Location: The North Spirit Lake area bounded by latitudes 52°28'45" and 52°37'30"N and by longitudes 92°45'00" and 93°05'00"W, covers the northern end of the North Spirit Lake-MacDowell Lake metavolcanic-metasedimentary belt. The area lies approximately 105 miles north-northeast of Red Lake. Access is by float-equipped aircraft.

Mineral Exploration: Prospecting in the area started in the 1920s (Hurst 1929), with the first recorded work done in 1928 (Bateman 1938). Initial interest was for gold, but, in more recent years, this has widened to include base metals, iron, and uranium.

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The Keevil Mining Group Limited has carried out airborne magnetic, electromagnetic, and spectrometer surveys on a group of claims held by CAM Mines Limited in the northwestern part of the area. Noranda Mines Limited has carried out diamond drilling on a group of claims southeast of Fregin Island. Kerr Addison Mines Limited is presently working on a group of claims along the north shore of North Spirit Lake directly north of South Bay. Spirit Lake Mines Limited is actively engaged in geological and geophysical work in the neighbourhood of W and Camp Islands and Bijou Point west of South Bay. Dickenson Mines Limited and a consortium composed of T.J. Day, J.H. Low, M.C. Gardiner Estate, and J.W. McBean have been actively investigating iron properties east of South Bay. Upper Canada Mines Limited has carried out magnetometer and geological surveys on the iron formation on the peninsula west of the East Bay of North Spirit Lake.

General Geology: The map-area covers the northern end of the North Spirit Lake-MacDowell Lake metavolcanic-metasedimentary belt which was mapped by Bateman (1938). The belt is approximately 7 miles wide in the map-area and is bounded on the west, north, and east by granitic batholiths. An east-west fault through North Spirit Lake effectively divides the area into two parts.

The bulk of the area north of the fault is underlain by granitic rocks; a triangular region to the east is underlain by metavolcanic and minor metasedimentary rocks. The volcanic rocks range in composition from basalt to rhyodacite. Interbedded tuffs, lapilli-tuffs and tuff breccias are common in the sequence. Quartz-magnetite iron formation occurs close to the stratigraphic horizon occupied by the felsic volcanic rocks. Although only about 200 to 300 feet thick, the iron formation can be traced for 3 miles along strike. Minor intrusions, variable in composition from felsic to mafic and probably related to volcanism, intrude the sequence. These intrusions generally are dike-like or sill-like in form, and precede the later phases of folding. Quartz feldspar porphyry is the most common rock type.

The belt of metavolcanics and metasediments has been intruded by granitic batholiths. Nearly all of the granitic rocks are biotite-bearing, some are hornblende-bearing. Compositions vary from quartz monzonite to diorite. The granitic rocks are in turn intruded by narrow syenitic dikes. Where the boundaries of the granitic batholiths and the metavolcanic-metasedimentary belt are concordant, the contact is sharp and inclusions in the granitic rocks are few. Where the granitic rocks crosscut the trend of the metavolcanic-metasedimentary belt, for example east of Iskotai Lake, a zone of migmatite and hybrid granitic rocks is present.

South of the fault through North Spirit Lake the lithologies in the metavolcanic-metasedimentary belt are diverse. In addition to rock types similar to those which occur in that part of the belt north of the fault, there is a large variety of sedimentary rock types. These include boulder, cobble, and pebble orthoconglomerates, pebble paraconglomerate, pebbly sandstone, grit, a variety of wackes with between 15 percent and 75 percent fine matrix, some arenites including some quartz arenite, laminated mudstone, graded wacke and mudstone, black shale, and carbonates. A notable feature of most of these rock types is the presence of sand-sized quartz grains. Granitic clasts are common in the conglomerates. Most of the volcanic rocks outcrop near the east side of the belt, although a band of tuffaceous rocks extends south-southeast from Pontoon Bay and Bijou Point. Iron formation is present near the eastern edge of the belt and appears to be underlain by the main volcanic part of the sequence and overlain by the main sedimentary part of the sequence. The iron formation in this part of the map-area is economically viable.

Intrusions thought to be related to the volcanism are also present within this part of the belt. These are similar to those north of the fault except for two larger bodies. One, west of the Indian Village, is about 1,000 feet across and dioritic in composition; the other, underlying Camp, W, and X Islands and most of Bijou Point approximates a biotite quartz diorite in overall composition and is 1-1/2 miles across at its widest point. These bodies have undergone metamorphism and deformation; they were probably emplaced during the early stages of the main episode of folding.

Toward the edges of the belt, the metamorphic grade of the volcanic and sedimentary rocks increases from lower greenschist facies to upper greenschist facies and lower almandine-amphibolite facies.

The metavolcanic-metasedimentary belt is intruded by granitic rocks similar to such rocks north of the fault.

One diabase dike postdates the batholithic intrusions.

Structural Geology: The fault which passes through the rocks under North Spirit Lake has already been mentioned. It is the youngest structural feature in the area and is accompanied by mylonite zones at both ends of the lake. The metavolcanic-metasedimentary belts both north and south of the fault are isoclinally folded with subhorizontal fold axes which usually parallel the edges of the belt. Drag folds with steeply plunging to vertical axes are common throughout both belts and postdate the isoclinal folds. Rodding often accompanies these drag folds. Cross folds, with axes generally at right angles to the axes of the isoclinal folds, are common east of South Bay and result in egg-crate outcrop patterns. The effects of these cross folds may easily be mistaken as the effects of faulting. West of South Bay there are east-northeast-trending faults which may be related to the cross folds

Economic Geology: There are few rocks in the area which do not contain some traces of sulphides.

Chalcopyrite, in association with pyrite, arsenopyrite, and gold, occurs in the biotite quartz diorite intrusion underlying Bijou Point and surrounding islands. It occurs as disseminated grains and also in quartz veins which occupy east-northeast-trending shears. Two grab samples collected by the author from the Spirit Lake Mines Limited property and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, yielded 2.51 percent copper, 0.67 ounces gold per ton ($23.45 per ton), 1.51 ounces silver per ton, and 3.31 percent copper, 0.38 ounces gold per ton ($13.30 per ton), 1.86 ounces silver per ton (gold at $35 U.S. per ounce). Chalcopyrite also occurs on the west side of East Bay adjacent to the iron formation. Galena and sphalerite occur together on the north shore of North Spirit Lake due north from Bijou Point. This occurrence lies adjacent to the granite contact in a shear zone striking a few degrees north of east. Either the granite intrusion or the shear zone or both may have served to concentrate the sulphides. A grab sample collected by the author from this locality and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, yielded 4.52 percent lead, 16.5 percent zinc, 0.01 ounces gold per ton ($0.35 per ton), and 6.42 ounces silver per ton (gold at $35 U.S. per ounce).

Pyrite and pyrrhotite are virtually ubiquitous in disseminated form. South of Pakwashkogan Lake pyrite occurs in the granitic rocks. Pyrite and pyrrhotite also occur south of Fregin Island and Pontoon Bay in wackes, mudstones, and derived schists. Such an occurrence has been investigated by Noranda Mines Limited. Pyrite, arsenopyrite, and pyrrhotite in various combinations are commonly found in the metavolcanic-metasedimentary sequence east of South Bay. Several of these occurrences have been pitted and trenched. In the triangular belt in the northeast part of the area, pyrite occurs disseminated in many of the volcanic rocks and also at the contact between the felsic metavolcanic sequence and the mafic metavolcanic sequence.

Although magnetite is commonly found in the granitic rocks, it is most important in the northeastern triangle and east of South Bay. The iron formation in the northeast part is not considered economic.

Exploration work east of South Bay has outlined twelve northwest-trending areas of quartz-magnetite iron formation ranging in length from 1,100 to 8,400 feet and in width from 120 to 1,100 feet. These contain an estimated 1,300,000 long tons of ore per verticle foot; 4,400 feet of drill core analyzed 33.96 percent total Fe (assessment work files, ODMNA, Resident Geologist's office, Red Lake).

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No. 3 OPERATION WINISK LAKE

DISTRICT OF KENORA (PATRICIA PORTION)

by

P.C. Thurston[1], R.P. Sage[1], and G.M. Siragusa[1]

Location: The map-region (shown in Figures 2b and 3b) is bounded by latitudes 54°00' and 52°30'N and by longitudes 86°00' and 90°00'W, with an extension at the west bounded by latitudes 53°00' and 52°30'N and by longitudes 90°00' and 92°00'W. The area comprises about 24,500 square miles. A small area, north of latitude 54°00'N and east of longitude 89°00'W was also mapped. Mapping was by helicopter-supported reconnaissance and by ground traversing in selected areas. Outcrop density is poor, particularly east of longitude 88°00'W, where exposures are found only along major streams. A generalized geologic map (Figures 2b and 3b) accompanies this report. Locations referred to in the text are lettered on the map. Part of the area south of latitude 53°00' was previously mapped under the Federal-Provincial "Road to Resources" program (Dufell *et al*. 1963).

General Geology: The area lies within the Gods Lake Belt (Wilson 1971) of the Superior Province and is crossed by three major volcanic-sedimentary belts: 1) the North Caribou Lake Belt; 2) the Big Trout Lake-Swan Lake Belt; 3) the Wunnummin Lake Belt. In addition, minor segments of the Amisk Belt (Goodwin 1968) are found in the northern part of the area. All of these belts have been noted in the course of previous work in the area or have been postulated on the Ontario Geological Map, Northwest Sheet (Ayres *et al*. 1971). Modifications have been made to the areal geology, particularly in the Big Trout Lake area and to the south in Nemeigusabins Lake area as well as in the northwestern part of the area (see Figure 2b, A).

Big Trout Lake-Swan Lake Belt: The belt extends from the Manitoba boundary eastward into the map-region (see Figure 2b). At the west boundary of the map-area, the belt is 8 miles wide and extends eastward for 22 miles. The Nemeigusabins arm of the Big Trout Lake Belt swings southward toward Nemeigusabins Lake, terminating just east of the Asheweig River. The margin of the belt is mainly composed of mafic metavolcanics, dominantly andesitic to basaltic in composition, occasionally pillowed. Often strongly developed layering is present. A minor occurrence of spherulitic and felsic volcanic breccia is found on the northern shore of Bear Island. Only minor amounts of metasediment (arkose and greywacke) are found along the southern margin of the fold belt (see Figure 2b, B). A large roughly concordant mafic body intrudes the belt, bounded on both sides by mafic metavolcanics. It extends from west of Post Island to the eastern end of the belt, from whence it continues round to extend westward to about the middle of the south shore of Big Trout Lake where it turns southward to Nemeigusabins Lake, a total length of about 50 miles. It attains a maximum width of 4 miles along the north shore of Big Trout Lake. The dominant phase is anorthositic gabbro; relatively minor

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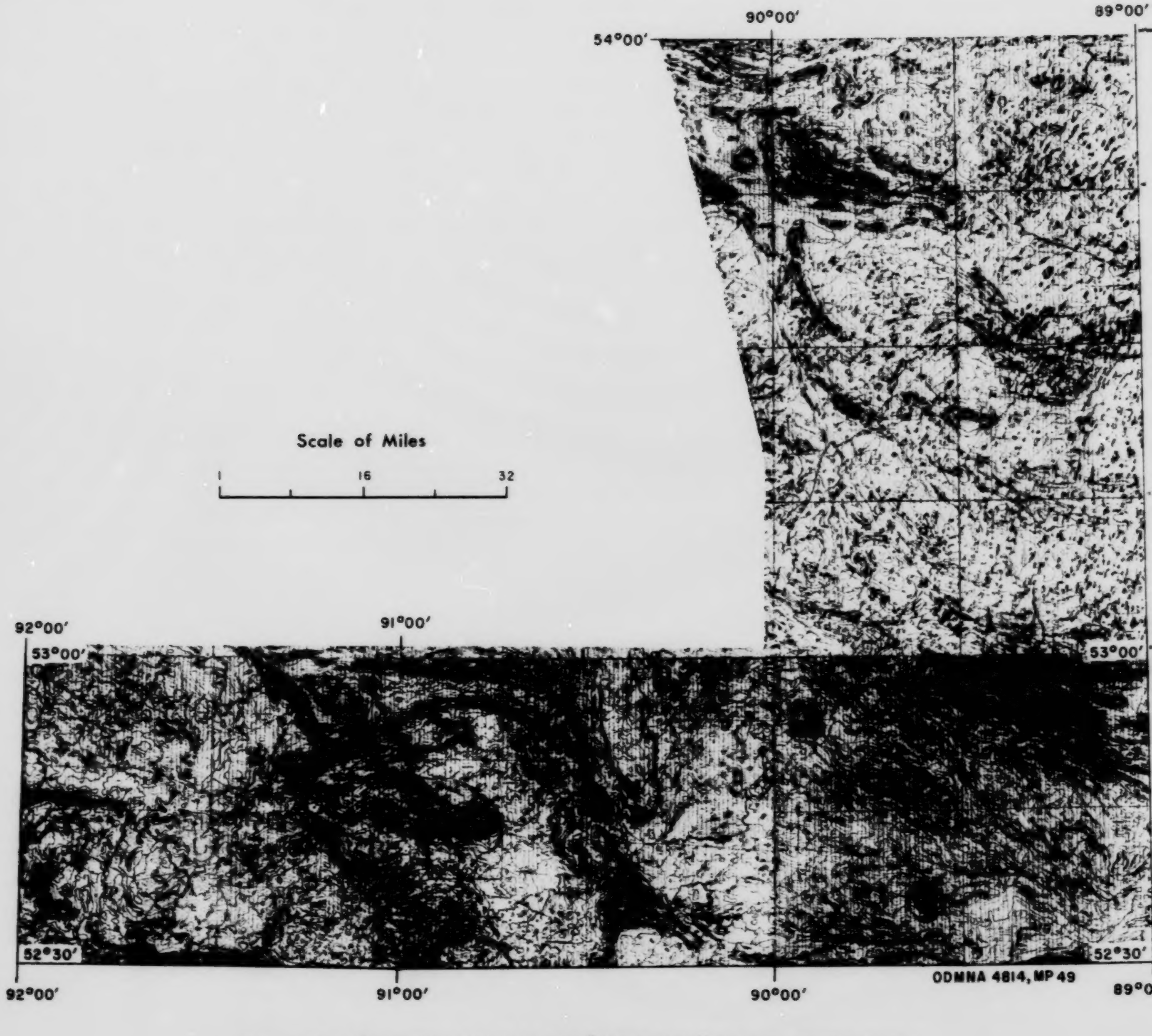
90°00'
89°00'
54°00'
Scale of Miles
1
16
32
92°00'
91°00'
53°00'
53°00'
52°30'
52°30'
92°00'
91°00'
90°00'
ODMNA 4814, MP 49
89°0

Figure 2a – Operation Winisk Lake (West Part), Aeromagnetic Map.

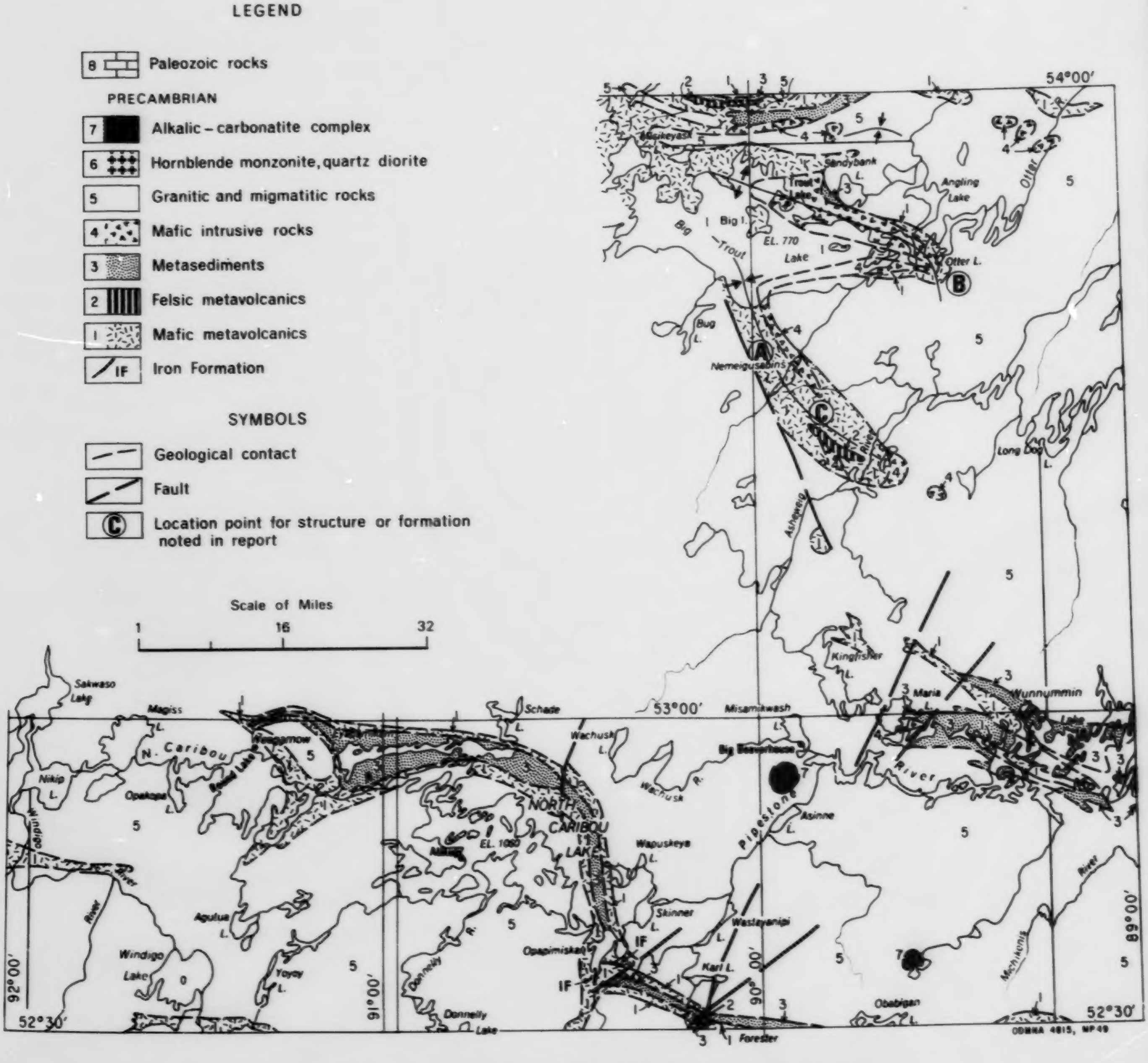
LEGEND
8 Paleozoic rocks
PRECAMBRIAN
7 Alkalic-carbonatite complex
6 Hornblende monzonite, quartz diorite
5 Granitic and migmatitic rocks
4 Mafic intrusive rocks
3 Metasediments
2 Felsic metavolcanics
1 Mafic metavolcanics
IF Iron Formation
SYMBOLS
Geological contact
Fault
C Location point for structure or formation noted in report
Scale of Miles
1
16
32
54°00'
53°00'
52°30'
92°00'
91°00'
90°00'
89°00'
Big Trout Lake
EL. 770
Sandybank L.
Angling Lake
Otter L.
Bug L.
Nemeigusabins
Long Dog L.
Kingfisher L.
Maria L.
Wunnummin Lake
River
Sakwaso Lake
Magiss L.
Schade L.
Misamikwash L.
Big Beaverhouse
N. Caribou
Nikip L.
Opakopa L.
Wachusk L.
Wachusk R.
NORTH CARIBOU LAKE
EL. 1060
Pipestone
Asinne L.
Wapuskeya L.
Agutua L.
Windigo Lake
Yoyoy L.
Skinner L.
Opapimiskan
Wastayanipi
Karl L.
Donnelly Lake
Obabigan L.
Forester
Michikenis River
A
B
C
IF
ODMNA 4815, MP49

Figure 2b – Operation Winisk Lake (West Part), Geological Map.

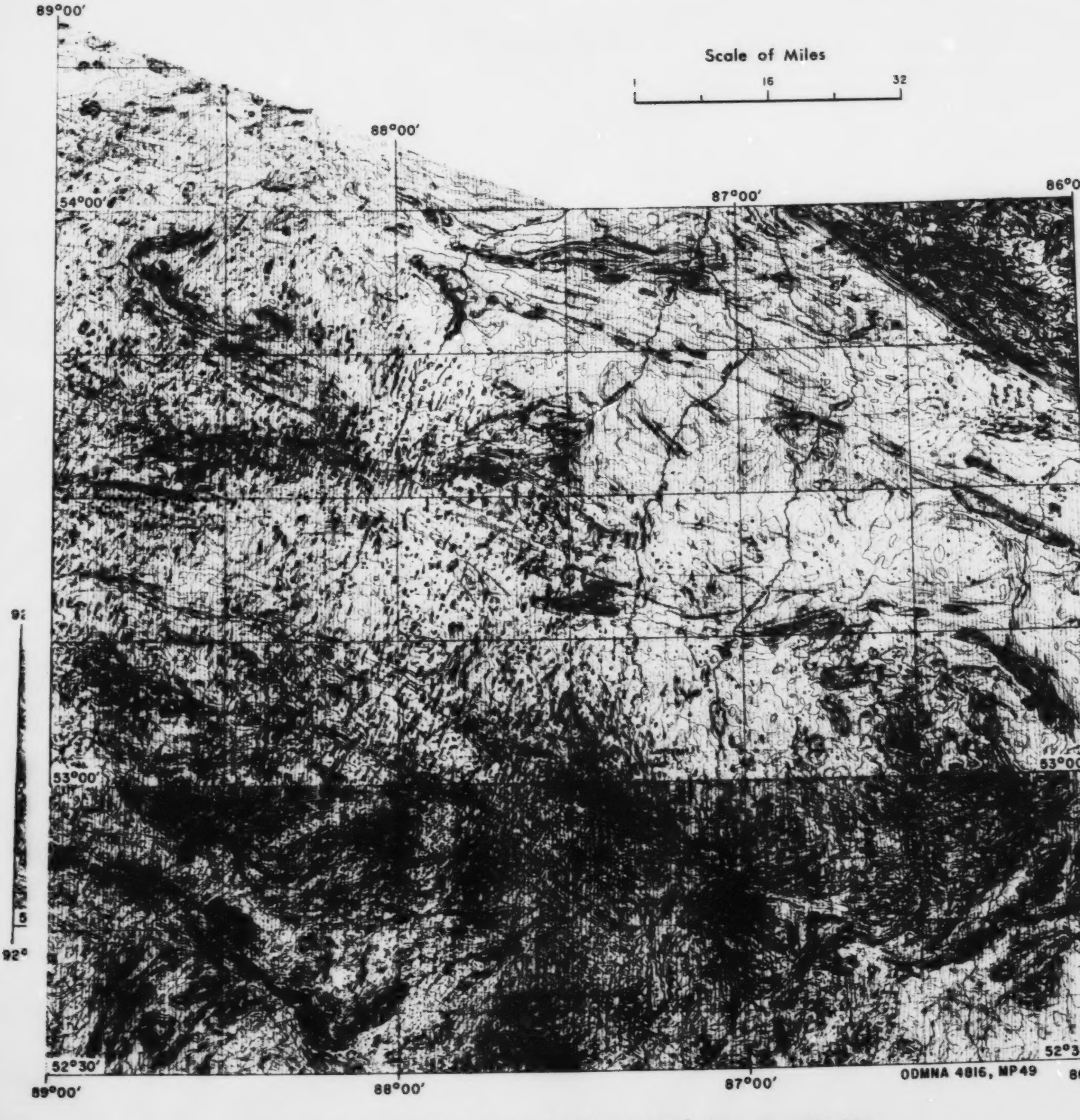
89°00'
Scale of Miles
16
32
88°00'
87°00'
54°00'
53°00'
52°30'
89°00'
88°00'
87°00'
ODMNA 4816, MP49

Figure 3a – Operation Winisk Lake (East Part), Aeromagnetic Map.

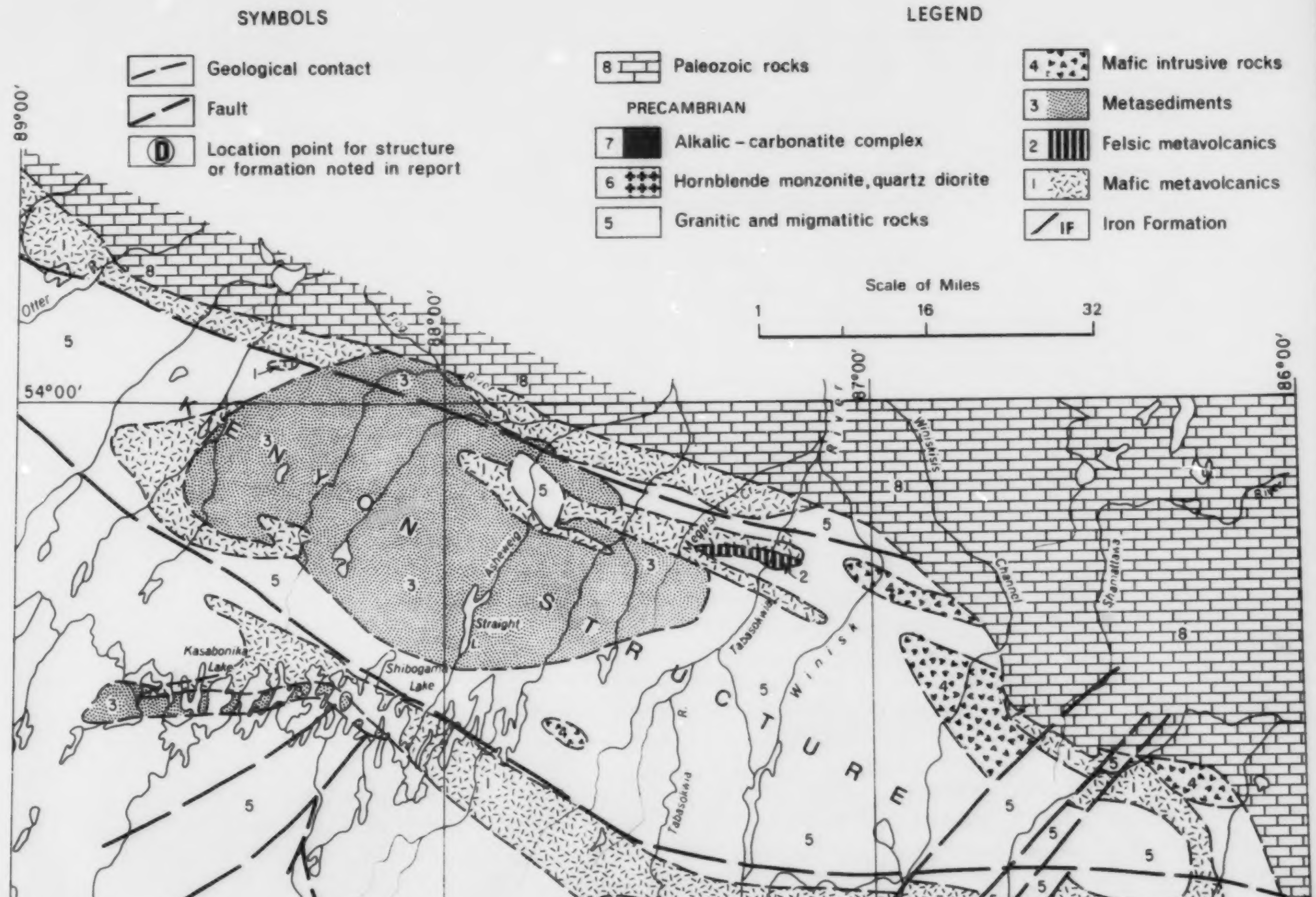
SYMBOLS
Geological contact
Fault
Location point for structure or formation noted in report
LEGEND
8 Paleozoic rocks
PRECAMBRIAN
7 Alkalic - carbonatite complex
6 Hornblende monzonite, quartz diorite
5 Granitic and migmatitic rocks
4 Mafic intrusive rocks
3 Metasediments
2 Felsic metavolcanics
1 Mafic metavolcanics
IF Iron Formation
Scale of Miles
1
16
32
89°00'
88°00'
87°00'
86°00'
54°00'
53°00'
52°30'
KENYON STRUCTURE
Otter
Fawn River
Asheweig
Straight L.
Shibogama Lake
Kasabonika Lake
Nogo
Tabasokwia R.
Winisk River
Winiskisis
Channel
Shamattawa
River
Tabasokwia
Kanuchuan R.
Tabasokwia L.
Lastcedar L.
Kanuchuan L.
WINISK
LAKE
Wapikopa L.
Winisk River
Chipai R.
Fishbasket River
Wapitotem River
Bartman L.
Ekwan River
G
D
E
F
ODMNA 4817, MP 49

Figure 3b - Operation Winisk Lake (East Part), Geological Map.

amounts of hornblendite, gabbro, metagabbro, and dioritic rocks are also present. The southern extension of the Big Trout Lake-Swan Lake Belt contains some felsic breccia and quartz-feldspar porphyry in the vicinity of Kaneesose Lake (see Figure 2b, B). Structural interpretation based primarily on pillow-top data suggests that the fold at Big Trout Lake is an east-plunging anticline (magnitude of plunge uncertain) and that the southern extension of the belt is a syncline overturned to the south.

North Caribou Lake Belt: The mapping of the geology of the North Caribou Lake Belt (see Figure 2b) concurs with the work done by Satterly (1939). Minor occurrences of iron formation and felsic tuff are found along the metasediment-metavolcanic contact north of Eyapamikama Lake. The outer margins of the belt consist of massive to strongly foliated mafic metavolcanics, occasionally pillowed. The central part of the belt is a sedimentary unit with lenticular beds of conglomerate, arkose, and greywacke grading stratigraphically upward into slate. Oxide- and silicate-facies iron formation is found north of Eyapamikama Lake in a band up to 125 feet wide. The length of this band was not ascertained. Minor occurrences of felsic tuff are found on strike with the iron formation to the west of Stanley Lake. At Opapimiskan Lake, the belt bifurcates with a southern extension, about 3/4 mile wide, passing through Libert Lake and thence out of the map-area; an eastern extension passes south of Karl Lake and possibly continues on beneath drift to the Forester Lake area.

Wunnummin Belt: This southeast-trending belt extends with variable width from the Mameigwess Lake area to northwest of Kingfisher Lake, approximately 105 miles (see Figures 2b, 3b).

West of Wunnummin Lake, the belt consists of two subparallel northwest-trending branches or segments: a northern and a southern one. The southern segment includes predominant metamorphosed conglomerate, greywacke, and arkose with lesser metavolcanics and metagabbro. This segment extends as far west as the northeastern shore of Maria Lake where it is truncated by a northeast-trending fault which has produced a sharp change in structural trend. The northern segment consists of well-foliated metavolcanics, predominantly andesitic in composition, extending to approximately 4-1/2 miles north of Maria Lake. Further west it blends into migmatite, thus losing its identity. An area of approximately 5 square miles immediately east of Kingfisher Lake is also underlain by foliated mafic metavolcanics with minor sulphide-facies iron formation. This could represent the original westernmost extension of the main belt from which they were separated by the previously mentioned structural disturbance.

In the Wunnummin Lake area, the belt consists predominantly of clastic metasediments with some metavolcanics and metagabbro. The metagabbro is spatially associated with the metasediments. Metasediments and metavolcanics consistently trend southeast and generally dip south at fairly steep angles. To the north of Wunnummin Lake, the contact between metasediments and regional granites is cataclastic in nature.

East of Wunnummin Lake, the belt forms a large southward projecting lobe in the area bound by longitudes 88°35' and 88°55'W and latitudes 52°30' and 52°40'N. The geophysical and geological trends of the mafic metavolcanics and iron formation underlying this area are approximately at right angles to the general trend of the rest of the belt. In this area, the belt reaches its maximum width of about 16 miles, but rock exposures are nearly nonexistent.

Occurrences of felsic metavolcanics in this belt are too small to be shown in Figure 2b and 3b. On the basis of the presently available data, however, one cannot exclude the possibility of the occurrence of significant amounts of felsic metavolcanics in the belt.

Field data combined with interpretation indicate that the association of mafic metavolcanics with rocks of quartz dioritic to dioritic composition is the dominant feature in the southeastern part of the belt. The dioritic rocks are probably related to local subvolcanic mafic plutons but may be, at least in part, mafic differentiates of the surrounding regional granites.

A late subrounded intrusive body with a diameter of about 5 miles and of medium- to coarse-grained monzonite with 4 to 8 percent hornblende (?) occurs at Wapikopa Lake (see Figure 3b, D).

Kasabonika Lake Belt: The mapping of the Kasabonika Lake area was refined in the course of this Operation (Thurston 1970). The aeromagnetic anomaly north of Wapikopa Lake is probably a metapyroxenite (inferred from boulders in glacial drift). The new mapping showed that the previously mapped boundaries of the volcanic-sedimentary belts had been satisfactorily located, with the exception of those of the Kasabonika Lake volcanic belt, which has been traced eastward to the Ekwan River where it swings north and then west to a point 5 miles east of the Winiskisis Channel and then terminates. North of Kasabonika Lake an extensive ill-defined mass of arkosic metasediments, 20 miles by 22 miles, is east of the Kasabonika Lake volcanic belt. It is bounded to the east, west, and south by volcanic-sedimentary belts, and to the north by presumably granitic rocks.

Other Belts: Just south of the Paleozoic contact, an as yet unnamed volcanic-sedimentary belt extends from the Tabasokwia Channel of the Winisk River to just west of the Asheweig River, a distance of 36 miles (see Figure 3b). It would seem from the limited data available that this belt consists dominantly of massive to foliated mafic metavolcanics with minor rhyolite, felsic tuff, and agglomerate exposed on the Tabasokwia Channel. A part of the belt extends beneath the Paleozoic rocks in the northern part of the Tabasokwia Channel.

In the area southeast of Winisk Lake, a poorly exposed mixture of mafic metavolcanics, diorite to gabbro, and minor metasediments occur (see Figure 3b).

The granitic rocks were mapped only in a general way. The most abundant types seem to be biotite granodiorite to trondhjemite, in large composite batholiths which include some areas of biotite and biotite-hornblende granite. Adjacent to some volcanic-sedimentary belts, "screens" of metasedimentary and metavolcanic migmatite occur over widths of a few miles. In particular, these are along the eastern margin of the North Caribou Lake Belt.

The granitic rocks are cut by late mafic and ultramafic intrusive rocks east of Wunnummin Lake (see Figure 3b, E), southeast of Winisk Lake (see Figure 3b, F), and at Weagamow Lake (see Figure 3b, G).

The Weagamow Lake occurrence, which is less than 1 square mile in area, consists of a small serpentinized dunite which has been previously described by Satterly (1939).

A few north-northeast-trending diabase dikes cut the North Caribou Lake Belt and adjacent granitic rocks.

Late Precambrian carbonatite intrusions occur at Schryburt Lake and Big Beaverhouse (Gittins et al. 1967). They are relatively small, poorly exposed, and have been known for some time (Ayres et al. 1971).

Structural Geology: The map-region lies in the Cat Lake and Cross Lake subprovinces of the Superior Province (Stockwell 1964), typified by a general east-west strike and isoclinal folding of the volcanic and sedimentary rocks. The Big Trout Lake-Swan Lake Belt is an east-plunging anticline, the axis of which passes through Post Island and then eastward (see Figure 2b). The southern extension of the belt (see Figure 2b, A,C) is an overturned syncline which extends from the Asheweig River north-northwest to the centre of Big Trout Lake. This interpretation is based solely on pillow-top determinations.

The North Caribou Lake Belt is an isoclinally folded syncline with unknown plunge. Minor folds are associated with the major syncline (see Figure 2b).

The Wunnummin Lake Belt shows evidence of tight isoclinal folding, but no interpretation is possible due to the lack of outcrop and facing data. Exposures of the other belts are too poor to postulate the type of folding (see Figure 2b).

Faulting in a north-northwest direction has displaced the volcanic-sedimentary belts in numerous places. A large scale structure, perhaps representing a fault, passes south of Nemeigusabins Lake separating the Cat Lake and Cross Lake Subprovinces of Stockwell (1964). The Kenyon Structure, another large scale feature which extends across the Manitoba boundary, seems to have deflected or cut off several of the minor volcanic belts in the northern part of the area (see Figures 2b, 3b).

Economic Geology: Prospecting activity, principally for gold, took place in the middle and late 1930s in the North Caribou, Big Trout, and Wunnummin Lake Belts (Satterly 1939; Hudec 1964, p.29; Prest 1940). Most of the early activity consisted of trenching and stripping.

Teal Exploration Limited held a block of 72 claims east of the Agutua Arm of Weagamow Lake in 1959-1960. The property is underlain by a carbonatized shear zone in mafic metavolcanics, which upon analysis gave values in copper, gold, and silver (Assessment work files, ODMNA, Parliament Buildings, Toronto). Drilling totalling 4,758 feet in 15 holes failed to find an extension of the zone beneath the surface. The property was reexamined in 1967, but since that year no work has been done on it.

Kenpat Mines Limited examined a gold occurrence in oxide-facies iron formation just south of Opapimiskan Lake in 1963. The gold appears to be associated with pyritic shear zones in the iron formation. After drilling of eight holes, totalling 1,305 feet, the property was abandoned.

Recently, Conwest Exploration Company Limited has been active west-southwest of Wunnummin Lake. Canadian Nickel Company Limited has been conducting geophysical surveys and diamond drilling throughout the area. Phelps Dodge Corporation of Canada Limited is known to be active in the area.

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No. 4 LANG-CANNON LAKES AREA

DISTRICT OF KENORA (PATRICIA PORTION)

by

K.G. Fenwick[1] and P. Srivastava[2]

Location: The area mapped during the 1971 field season covers approximately 85 square miles; it is the east end of the Lang-Cannon Lakes metavolcanic-metasedimentary belt that lies north and south of the Gitche River and between Cannon and Littleford Lakes. The centre of this area is about 125 miles east-northeast of Red Lake and 40 miles west-northwest of Pickle Lake. The map-area is accessible by float-equipped aircraft.

Mineral Exploration: In 1929, H.C. Laird (1930) and, in 1960, R.F. Emslie (1961) made reconnaissance geological surveys of the map-area.

Amax Exploration, Incorporated (Assessment work files, ODMNA, Resident Geologist's office, Red Lake) has 88 claims in the Card Lake-Gitche River area. In 1970, magnetic and electromagnetic surveys were conducted.

New Jersey Zinc Exploration Company (Canada) Limited (Assessment work files, ODMNA, Resident Geologist's office, Red Lake) has a copper-nickel property 2 miles east of McVicar Lake. In 1969 and 1970, magnetometer, electromagnetic, geological, and geochemical surveys were conducted. In 1971, this company drilled five holes with a total of approximately 675 feet.

Bochawna Copper Mines Limited and Card Lake Copper Mines Limited jointly hold a copper-nickel property of 27 claims in an area 2 miles west of Wettlaufer Lake. In 1969, a magnetometer survey was conducted and three holes were drilled for a total of 750 feet. In 1970, an electromagnetic (vertical loop) survey was conducted and an additional four holes were drilled for a total of 893 feet.

The Hanna Mining Company was active, during the summer of 1971, in the area north of McVicar Lake.

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[2] Instructor, Department of Geology, Sir George Williams University, Montreal.

General Geology: All bedrock in the map-area is Precambrian in age. The Lang-Cannon Lakes area is underlain by metavolcanics and metasediments that form a narrow belt which is approximately 30 miles long and varies in width from 1/4 to 7 miles. The western part of this belt was mapped in 1969, the central part in 1970, and the eastern part in 1971.

The belt east of McVicar Lake separates into two parts, a northern and a southern, each underlain by metavolcanics, with a large metasedimentary sequence, approximately 11 miles long and 4 miles wide, in between. The belt is completely surrounded by granitic rocks.

The northern metavolcanic sequence lies north of the Gitche River and consists mainly of fine-grained amphibolite and amphibolite schist with a few intercalated tuffaceous bands. The southern metavolcanic sequence lies between the Gitche and Meen Rivers and shows a greater variation of rock types than the northern sequence. These rocks consist of medium- to fine-grained, massive to foliated and pillowed, mafic to intermediate metavolcanics.

A small lens of felsic metavolcanics, approximately 1 mile long and 1/4 mile wide, was noted 1 mile northeast of Jutzi Lake and lies between the southern metavolcanic sequence and the metasediments. It consists of well-foliated, pale grey weathering, fine-grained flows and tuff breccia.

The metasediments are mainly foliated quartz-biotite-garnet paragneiss in the northern part of the sequence, with a band of conglomerate and siltstone in the southern part of the sequence. The conglomerate is 2,310 feet wide west of Cannon Lake. The metasedimentary sequence terminates abruptly against a granitic intrusive rock along the eastern limit of the map-area.

Drumlins and drumlinoid ridges, striking S70W, are abundant in the area.

Structural Geology: The major structure in the area is a syncline that trends about N70E and plunges 40 to 60 degrees east. The syncline is isoclinal and its axis is located approximately in the central part of the metasedimentary sequence.

Several topographic lineaments were noted. The most prominent strikes N25E through Littleford Lake. Other intersecting lineaments trend roughly east-west along the Gitche River.

Economic Geology:

Iron: Iron formation has been found throughout the map-area intercalated with mafic metavolcanics and metasediments. Fifty feet was the maximum width observed.

Sulphides: A sulphide iron formation, with disseminated pyrite, pyrrhotite, magnetite, and chalcopyrite and intercalated with fine-grained mafic tuffaceous bands, was noted on the property jointly held by Card Lake Copper Mines Limited and Bochawna Copper Mines Limited. The rocks trend N75E and dip vertically. Drilling has indicated low copper-nickel values over a width of 100 feet (Northern Miner 1970, p.142).

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No. 5 NARROW LAKE-SHABUMENI RIVER AREA

(SKINNER AND GOODALL TOWNSHIPS)

DISTRICT OF KENORA (PATRICIA PORTION)

by

A.P. Pryslak[1]

Location: Goodall and Skinner Townships are located 47 miles east-northeast of the town of Red Lake and are accessible by float-equipped aircraft. The area mapped during the 1971 field season includes all of Goodall Township and 75 percent of Skinner Township. The unmapped section of Skinner Township and the area lying north to latitude 51°22'N and west to longitude 93°00'W is expected to be completed in 1972.

Mineral Exploration: Prospecting for gold in the Birch-Uchi Lakes metavolcanic-metasedimentary belt began in the 1920s. Bathurst Gold Mines Limited operated sporadically between 1927 and 1937. A shaft was sunk to 300 feet and the total recorded production is 307 ounces of gold and 92 ounces of silver (Statistical files, ODMNA, Toronto).

In 1928, a shaft was sunk to a depth of 271 feet on the Dunkin Gold Mines Limited property on Narrow Lake. No production of gold or silver has been recorded.

The earliest recorded date in the exploration for base metals in the map-area is 1966. Cana Exploration Consultants Limited carried out a ground geophysical survey over a group of 18 claims located in the area bounded by

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[1] Geologist, Ontario Department of Mines and Northern Affairs, Red Lake.

Bathurst and Carr Lakes. Subsequent drilling on the property was done in 1967 by Victoria Algoma Mineral Company Limited, and in 1969 by Kendon Copper Mines Limited.

During the period from 1969 to the time of this report, the following companies have carried out exploration programs in the map-area (Assessment work files, ODMNA, Resident Geologist's office, Red Lake): Bralorne Can-Fer Resources Limited, Canex Aerial Exploration Limited, Falconbridge Nickel Mines Limited, Noranda Exploration Company, Selco Exploration Company Limited, South Bay Mines Limited, and Vanco Exploration of Ontario, Limited.

General Geology: The map-area is underlain mainly by an Early Precambrian metavolcanic-metasedimentary belt. Granitic batholiths underlie the extreme northwestern and southwestern parts of Skinner Township.

The belt is composed predominantly of metavolcanics. A lower formation, comprised mainly of mafic metavolcanics, is in the southwestern part of Skinner Township. The formation trends north to northwest, is at least 8,000 feet thick, and consists of pillowed, variolitic, and massive flows.

Metavolcanics of intermediate to felsic composition overlie the lower mafic formation. The sequence has a minimum thickness of 9,000 feet and trends north to northwest. Tuffs and tuff breccias of intermediate composition predominate, but felsic tuffs occur in the upper part of the sequence. Porphyritic and amygdaloidal flows, of intermediate to mafic composition, are locally present throughout the sequence.

A second formation that is composed predominantly of pillowed and massive mafic flows overlies the sequence of felsic to intermediate metavolcanics. The formation is at least 16,000 feet thick and occupies the area lying to the east of Woman Lake and south of Swain Lake. Minor lenses of intermediate flows and pyroclastic rocks occur in the formation, which trends north-south except in the northern part of the area where the trend is northeast.

An east-west-trending sequence of metavolcanics occurs in the extreme north-central part of the map-area. The metavolcanics vary in composition from felsic to mafic. Pillowed and massive flows predominate in the mafic metavolcanics whereas the intermediate to felsic metavolcanics are composed largely of pyroclastic material.

Metasediments form less than 5 percent of the rocks in the belt. One formation outcrops along the east shore of Woman Lake. It varies in thickness from 500 to 1,000 feet and is composed of conglomerate, greywacke, and minor argillite. The fragments in the conglomerate are derived largely from felsic metavolcanics.

A second formation occurs at the east end of Narrow Lake. It is composed of conglomerate, greywacke, and graphitic argillite. This formation has been traced over a strike-length of about 2 miles and has a maximum thickness of 2,000 feet.

Minor units of greywacke, argillite, and chert occur intercalated with the metavolcanics. These units are generally less than 200 feet thick.

The metavolcanic-metasedimentary sequence was intruded by intrusions ranging in composition from felsic to ultramafic. Serpentinized ultramafic rocks occur in Skinner Township in the form of sills and dikes. These are coincident with positive aeromagnetic anomalies (ODM-GSC 1960a; 1960b).

Sills, dikes, and irregular bodies of metagabbro and metadiorite form about 5 percent of the map-area.

Dikes and small stocks of altered granodiorite and quartz porphyry occur in the southeastern part of Goodall Township.

Metamorphosed quartz porphyry and quartz-feldspar porphyry occur as small stocks in the northwestern part of Goodall Township and the northeastern part of Skinner Township.

Structural Geology: The metavolcanic-metasedimentary sequence has been isoclinally folded with a north-south-trending synclinal axis lying east of the map-area (Goodwin 1967).

A synclinal fold, trending approximately east-west, occurs in the north-central part of the map-area. Data are insufficient to establish an accurate location of the fold axis or to determine the plunge of the fold.

Numerous faults have been recognized in the area. They generally trend in a northeast direction and display right-hand strike separations.

Economic Geology:

Gold: The known gold occurrences in the area are found in quartz veins containing minor amounts of sulphides. Pyrite is most common but sphalerite, galena, and chalcopyrite occur in some of the veins. Grab samples collected from 17 veins in Goodall Township and tested by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, were found to assay less than 0.04 ounces gold per ton and trace amounts of silver.

Sulphides: A sulphide-bearing quartzite was mapped in Goodall Township, 3/4 mile west of the north end of Woman Lake. The formation trends east-west, dips vertically, is up to 60 feet in width, and has been traced over a length of 250 feet. Disseminated pyrite with seams of massive pyrite and minor pyrrhotite constitute about 15 percent of the formation. Analyses results are pending.

During 1970, South Bay Mines Limited drilled six diamond drill holes in the northwestern part of Goodall Township and three holes in the northeastern part of Skinner Township. All holes intersected graphitic argillite containing disseminated pyrite and stringers of massive pyrite and pyrrhotite. Minor amounts of chalcopyrite and sphalerite were reported (Assessment work files, ODMNA, Resident Geologist's office, Red Lake).

Minor amounts of chalcopyrite were found at fifteen localities. Two occurrences are in metasediments and thirteen are in intermediate to mafic metavolcanics. Five occurrences are concentrated along the shore of the small lake that lies to the northwest of Woman Lake. The mineralization occurs along fractures and constitutes less than 1 percent of the host rocks.

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No. 6 TODD AND FAIRLIE TOWNSHIPS

DISTRICT OF KENORA (PATRICIA PORTION)

by

R.A. Riley[1]

Location: Todd and Fairlie Townships are centred about 10 miles west-northwest of the town of Red Lake and are accessible by boat and float-equipped aircraft.

Mineral Exploration: The metavolcanic-metasedimentary sequences in the map-area have been extensively prospected for gold since 1926 by numerous companies and individuals. These programs culminated in underground exploration on four properties between 1936 and 1958 and production of 276.769 ounces of gold and 65 ounces of silver from the property of Red Crest Gold Mines Limited in 1935 and 1936 (Statistical files, ODMNA, Toronto).

Only minor base metal exploration was carried out prior to 1965, at which time about three-quarters of the favourable prospecting area was subjected to airborne electromagnetic and magnetic surveys by Cochenour Willans Gold Mines Limited; the remainder of the area was flown in 1970. Ground follow-up of this survey was carried out from 1966 to 1970 by Cochenour Explorations Limited and Coin Lake Gold Mines Limited, an associated company. Dickenson Mines Limited undertook some general prospecting, a magnetometer survey, and some diamond drilling in the area north of Middle Narrows in 1964 and 1965. General prospecting, electromagnetic and magnetic surveys and reconnaissance geological and geochemical surveys were carried out in the area north of Wolf Narrows by D.A. Smith from 1968 to 1970. Madsen Red Lake Gold Mines Limited undertook electromagnetic and magnetic surveys followed by a diamond drilling program in the Fisher Islands area in 1970 and 1971. In 1971, Texas Gulf Sulphur Company carried out general prospecting, and electromagnetic, magnetic, geochemical, and geological surveys in the Hall Bay area and the area east of the northeast end of Pipestone Bay. C.D. Huston drilled two short holes on a silver-zinc showing in the Middle Narrows area in 1971.

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[1] Resident Geologist, Ontario Department of Mines and Northern Affairs, Red Lake.

General Geology: Massive to pillowed mafic metavolcanic flows underlie about 20 percent of the map-area. The main area of mafic metavolcanics lies between Martin Bay and Golden Arm and on the peninsula between Wolf Bay and Golden Arm. Extensions of these units can be traced northwest toward Pipestone Bay and east across Fairlie Township. A second major unit of mafic metavolcanics can be traced from Wolf Narrows through the Middle Narrows area to the Fisher Islands and St. Paul Bay . Mafic metavolcanics on the north side of Martin Bay and on some of the islands southeast of Martin Bay are highly carbonatized.

Intermediate metavolcanics underlie about 5 percent of the map-area. Fine to coarse pyroclastic rocks are common as interflow units in the mafic metavolcanic sequences. Together with mafic and felsic metavolcanics and metasediments, they form a mixed unit up to 4,000 feet thick between Pipestone Bay and Rowan Lake. As a unit up to 450 feet thick they also stratigraphically underlie metasediments southeast of Wolf Bay, and they occur north of Parker Falls intercalated with mafic metavolcanics. Intermediate pillow lava, pillow breccia, and flow breccia occur on the islands north of Parker Falls and tuff breccia and pillow lava occur on the southwest end of the most southerly of the Fisher Islands.

Felsic metavolcanics underlie about 10 percent of the map-area and are common only in the west part of Todd Township. A series of massive, fine-grained, porphyritic flows (?), about 2,000 feet thick, can be traced from West Narrows through Hall Bay to Golden Arm. Porphyritic lava, fine to coarse pyroclastic rocks, and locally derived metasediments can be traced from Saddler Bay to Rowan Lake where they are intercalated with iron formation. North and west of Rowan Lake porphyritic felsic flows are intercalated with mafic and intermediate metavolcanic units and metasediments.

Metasediments underlie about 20 percent of the map-area. The largest unit extends along the north boundary of the metavolcanic-metasedimentary belt from Pipestone Bay to Slate Bay, where it is exposed over a width of about 8,000 feet. These rocks range from granite-boulder conglomerate to siltstone, with fine-grained greywacke predominating. A unit of magnetite-chert iron formation up to 500 feet thick lies along the south boundary of this unit in Fairlie Township. A second major unit of metasediments, possibly as much as 3,000 feet thick, can be traced from the south end of Wolf Bay through Martin Bay to McKenzie Island. Metasediments of this unit range from pyritiferous and pyrrhotiferous argillite and siltstone, iron formation, conglomerate, and minor marble in the Wolf Bay area; to medium- to coarse-grained sandstone and minor conglomerate in the Martin Bay area; to greywacke, siltstone, and marble in the Fisher Island area. Several narrow mixed units of marble, iron formation, and greywacke are associated with metavolcanic units in the Phillips Channel, Hann Lake, Hall Bay, and Golden Arm sections of Todd Township.

A few small stocks, sills, and dikes of metagabbro are associated with mafic metavolcanics and ultramafic rocks. A late stock of gabbroic anorthosite occurs along the contact between metasediments and granitic rocks between Hammell and Para Lakes. Serpentinites and serpentinized peridotites and pyroxenites occur south of Pipestone Bay, along and west of Golden Arm, in Middle Narrows, on and west of the southerly Fisher Islands, and east of St. Paul Bay. Lamprophyre dikes cut the Dome Stock.

Small epizonal stocks, sills, and dikes of metamorphosed equigranular to porphyritic trondhjemite to quartz monzonite, quartz diorite, and diorite occur throughout the metavolcanic-metasedimentary sequence. The epizonal Dome Stock consists of massive to inclusion-ridden hornblende to biotite-hornblende diorite and quartz diorite in the Fisher Islands area, and hornblende granodiorite in the southeastern part of Fairlie Township. Hornblende to biotite-hornblende trondhjemite and granodiorite underlie the southwestern parts of Todd and Fairlie Townships. The granitic rocks along the north boundary of the map-area are composed of coarse-grained equigranular to porphyritic biotite-hornblende trondhjemite and granodiorite. Equigranular to porphyritic trondhjemite to quartz monzonite dikes commonly cut the large late felsic intrusions.

Structural Geology: Preliminary interpretation suggest the presence of an east-plunging anticline and a flanking syncline to the south, trending across the central part of the map-area. It further suggests that the Wolf Bay and Trout Bay metasedimentary units may be laterally equivalent, as may be the carbonate units in the Hann Lake area and a skarn unit (Riley 1970) on the north side of Pipestone Bay in Ball Township. No major faults have yet been identified in the map-area.

Economic Geology: In the metavolcanic-metasedimentary sequence gold occurs with quartz, with or without one or more of pyrite, pyrrhotite, sphalerite, chalcopyrite, galena, and arsenopyrite, in shear zones or tension fractures in practically all rock types. Of 228 samples collected during the field season and submitted to the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, 25 samples gave more than trace amounts of gold upon assay, and of these only 10 returned more than 0.1 ounces gold per ton. One of the latter group, from a narrow untested quartz vein cutting mafic metavolcanics at the southwest end of the south bay of Hammell Lake, returned 0.82 ounces gold per ton and 0.12 ounces silver per ton. Silver was reported present in amounts greater than 0.05 ounces per ton in 62 samples. Sulphide-bearing gold-quartz veins from the waste dump near the Altura Gold Mines Limited shaft, and from a prospect located about 3/4 mile south of the centre of Para Lake, respectively returned silver values as high as 5.67 ounces per ton and 1.90 ounces per ton as well as high gold values. Silver is widespread on the peninsula south of Wolf and Martin Bays where it occurs with sphalerite, galena, pyrite, arsenopyrite, and minor chalcopyrite in narrow, interflow, intermediate tuff breccia units. Samples from these zones also analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, were found to contain up to 8.27 ounces silver per ton, 1.95 percent zinc, 1.05 percent lead, 0.05 percent copper, and 0.14 ounces gold per ton.

Massive to disseminated pyrrhotite and pyrite in varying amounts and containing trace amounts of chalcopyrite are present in the metasedimentary unit in the Wolf Bay-Martin Bay area and northeast along the north shore of Red Lake. Similar mineralization associated with iron formation, greywacke, and marble has been investigated by diamond drilling in the Golden Arm area. Diamond drilling results also indicate minor amounts of chalcopyrite and sphalerite in pyrite-pyrrhotite-rich zones in interflow iron formation and siltstone units, and in fracture zones in mafic metavolcanics west of Martin Bay.

Chalcopyrite and malachite with pyrite and pyrrhotite have been reported from a narrow gossan zone in mafic metavolcanics and from lean iron formation in the northernmost of the two large islands immediately west of the Dome Stock (Riley 1971). Samples collected during the field season from the north end of the iron formation unit and showing chalcopyrite along bedding planes and in tiny cross fractures were found, by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain up to 0.65 percent copper. Values up to 0.53 percent nickel, 0.38 percent copper, 0.24 ounces silver per ton, and trace gold have been obtained from samples collected by the author from a reef in the northeast end of Pipestone Bay. Pyrrhotite, chalcopyrite, and malachite occur in and along pillow rims in a hornfelsed mafic metavolcanic. The nickel mineralization is thought to be related to the large ultramafic stock underlying Pipestone Bay (Riley 1970).

Sparsely disseminated chalcopyrite was noted in a massive medium- to coarse-grained metagabbro unit at two locations on the west shore of Golden Arm but analyses by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, indicated only trace copper. Similar mineralization in quartz diorite occurs in two localities on the south shore of Red Lake west of St. Paul Bay. Chalcopyrite occurring as disseminations and joint-fillings is found in Dome Stock granodiorite on the peninsula north of St. Paul Bay. Similar mineralization with erratic gold values and minor molybdenite has been traced intermittently for three miles across the southern part of the stock but its economic potential is not yet known.

Immediately south of the map-area on the south shore of St. Paul Bay a massive pyrrhotite zone containing minor chalcopyrite occurs in felsic metavolcanics on the north side of an ultramafic sill. Nickel values to 0.58 percent (A. Kostynuk, personal communication) have been reported by prospectors from the zone suggesting that both the ultramafic intrusions and felsic metavolcanic units in this area should be thoroughly investigated for their base metal potential.

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No. 7 CEDARTREE LAKE AREA

DISTRICT OF KENORA

by

J.C. Davies[1] and J. Morin[2]

Location: The map-area lies about halfway between Kenora and Fort Frances and is bounded by latitudes 49°15'00" and 49°22'30"N and by longitudes 93°45'00" and 94°05'00"W. Most lakes in the area are accessible from Highway 71, which extends through the western part of the map-area.

Mineral Exploration: Gold was discovered northwest of Kakagi Lake about 1897; and in the vicinity of Flint Lake about 1900. Minor gold production was recorded from the former area for the years 1904 to 1906. Exploration of numerous gold properties occurred up to 1961. From 1935 to 1950 much of this exploration was centred near Flint Lake.

Base metal exploration programs have been carried out since 1955 by a number of companies, principally in the southern half of the map-area. At Wisener Lake a copper-zinc occurrence was drilled by Noranda Mines Limited in 1961.

General Geology: The map-area lies at the southeastern part of the type-Keewatin section described by Lawson (1885) and has been shown by McInnes (1902) and Burwash (1933) to be mainly underlain by metavolcanics. The eastern contact of the Aulneau granitic batholith occurs at the west boundary of the area.

The oldest rocks of the area are fine- to medium-grained flows with numerous pillows and minor pillow and flow breccia. Some of the coarser grained phases are extensive and may be intrusions. The mafic metavolcanic unit appears to be relatively uncomplicated structurally in the southwestern part of the area where it has a thickness of about 15,000 feet. There is a strong foliation in the rocks close to the Aulneau batholith.

Lying above the mafic rocks, in part at least concordantly, are intermediate pyroclastic rocks which contain very little bedding. The clasts are mostly subrounded andesitic to dacitic porphyries which are elongate in a vertical direction. The thickest section of these rocks, about 14,000 feet, occurs at Emm Bay and coincides with a fold axial trace.

Above the intermediate pyroclastic rocks, though gradational with them, are about 4,000 feet of mixed felsic pyroclastic rocks and derived, well-bedded siltstone and greywacke. The top of the metavolcanic section, exposed at Stephen Lake, consists of about 7,000 feet of felsic flows and partially bedded ash flows.

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[2] Graduate student, Department of Earth Sciences, University of Manitoba, Winnipeg.

Differentiated ultramafic to mafic sills lie within the intermediate to felsic pyroclastic rocks. The lowermost is a composite sill consisting of at least two units. It extends through Emm Bay, possibly along a fault zone, and contains a high proportion of peridotite and pyroxenite. A second sill trending through Cedartree Lake is the simplest, containing a narrow ultramafic zone at the base and a coarse, somewhat pegmatitic, section at the top. A third sill, east of Cedartree Lake, contains a uniform lower peridotite zone, which has been removed over a length of 8,000 feet by faulting, and an upper gabbroic zone. Both the second and third sills appear to have been emplaced along well-bedded horizons. Part of a peridotite-gabbro sill occurs near the southeast end of Stephen Lake but its relation to the upper sill is not known.

The two main felsic intrusive bodies are the Aulneau Batholith and the Little Stephen Lake Stock. The batholith is granodioritic with essentially concordant contacts, and in places contains small fragments of mafic metavolcanics aligned parallel to foliation. The stock is heterogeneous, varying from medium-grained pink granite to coarse-grained hornblende diorite, and contacts are mostly discordant. Numerous quartz-feldspar porphyries and feldspar porphyries occur within the mafic metavolcanics, especially in the vicinity of Wapus Lake.

Diabase dikes extend through the southwestern and northeastern parts of the map-area.

Sturctural Geology: The principal structural feature is the major fault and shear zone which extends through Dogpaw, Flint, and Stephen Lakes. This fault separates a section of essentially mafic metavolcanics to the northeast from the complete mafic to felsic sequence to the southwest. Relative movement is thought to be mainly vertical with the northeast side up, but lineations indicate movements may have been complex. Numerous other faults are evident in the well-exposed section of pyroclastic rocks and mafic sills; an intensely carbonatized zone at the base of the Emm Bay Sill may be a fault zone. Within the mafic metavolcanics evidence of faulting is difficult to establish.

Two fold axes, which trend east-northeast, are apparently truncated by the major fault zone. The anticlinal axis is poorly defined but lies in the vicinity of Wapus Lake. The synclinal axis is well defined near the south end of Cedartree Lake, but to the west the fold is more open and to the east the fold is obscured by granitic rocks. Isoclinal folding occurs within mafic metavolcanics in the northwestern part of the map-area and possibly in the northeastern part, but elsewhere evidence of isoclinal folding is lacking.

Economic Geology: Although gold occurrences have been reported in most of the rock types, the majority are associated with quartz veins in sheared or fractured mafic to intermediate metavolcanics, or in porphyry dikes within these rocks. The veins are mostly small or discontinuous and the gold erratic in its occurrence. At least two large carbonate-bearing zones containing some pyrite and quartz have low gold values; higher grade sections may be found in these zones.

The felsic pyroclastic rocks and derived bedded rocks contain pyrite and pyrrhotite and, in places, traces of chalcopyrite. The copper-zinc occurrence drilled by Noranda Mines Limited near Wisener Lake occurs in these rocks, but there is no available information on grade or tonnage. Several geophysically anomalous zones within the pyroclastic rocks have been drilled but it would appear that these zones contain only traces of base metal sulphides. It is not known whether any of the geophysical work has been appropriate for the location of disseminated sulphide.

Near the top of the gabbro, west of the Flint Lake-Stephen Lake portage, there is some fine pyrrhotite. For the most part however, the mafic and ultramafic sills contain very little sulphides.

The larger granitic bodies are mostly devoid of sulphides, but molybdenite has been reported near the contact of the Little Stephen Lake Stock northwest of Wisener Lake.

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No. 8 OFF LAKE-BURDITT LAKE AREA

DISTRICT OF RAINY RIVER

by

C.E. Blackburn[1]

Location: Burditt Lake, also called Clearwater Lake, is situated about 28 miles northwest of Fort Frances in the District of Rainy River. The map-area is bounded by latitudes 48°50' and 49°00'N and longitudes 93°35' and 94°10'W and covers approximately 300 square miles. All parts of the area are readily accessible by roads and water routes. Highway 71, the main route between Fort Frances and Kenora, runs north-south through the middle of the area; Burditt and Off Lakes can be reached directly by way of Highway 615 from Highway 71.

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Mineral Exploration: Evidence of early prospecting, probably for gold, is seen in the old pits in the vicinity of Off Lake.

In 1956, nine holes were diamond drilled with a total of 2,000 feet on the property of E. Corrigan and D.R. Young on three claims, two on the southwest shore of Off Lake, and one 1/2 mile south of the same lake. Minor amounts of chalcopyrite, magnetite, and, in one hole, molybdenite were found in association with disseminated pyrite. In 1960, further drilling by E. Corrigan of two holes totalling 240 feet on the claims on the shore of Off Lake failed to give more favourable results (Assessment work files, ODMNA, Resident Geologist's office, Kenora).

The discovery by A. Dunge in 1967 of copper mineralization in a hole drilled for a water well at the north end of Off Lake touched off a staking rush in the vicinity of Off and Burditt Lakes. Noranda Exploration Company (Assessment work files, ODMNA, Resident Geologist's office, Kenora) carried out magnetometer, induced polarization, and resistivity surveys during the winter of 1967, followed by geological mapping and the diamond drilling of three holes, totalling 767 feet, two in the vicinity of the discovery and another to test an induced polarization conductor. Only minor amounts of chalcopyrite and pyrite were found in these holes. During the same period, Noranda Exploration Company acquired a number of claim groups between Highway 71 and Burditt Lake, on which geophysical surveys were carried out, and drilling of three additional holes totalling 800 feet. Most of these claim groups have since been dropped, as has the option on the Off Lake Group.

During the summer of 1971, The International Nickel Company of Canada Limited carried out ground electromagnetic surveys as follow-up to airborne surveys, in the general region south from the present map-area to the Minnesota border. To date, no claims have been staked by the company in the map-area as a result of this work, although considerable work was done by the geophysical crew in the southwestern part, mostly on patented farm land, and claims have been staked immediately south of the map-area close to Highway 615.

Of some interest is a bismuth showing on a group of three patented claims close to Jackfish Lake in the northeastern part of the map-area. These claims were first staked by H. Vinall in 1938 for copper and gold mineralization. Pitting and trenching during the period up to 1948 uncovered bismuthinite in a narrow quartz vein. An analysis by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, of a sample collected from the quartz vein in 1948 by E.O. Chisholm, Resident Geologist in Kenora, gave 1.53 percent bismuth (Assessment work files, ODMNA, Resident Geologist's office, Kenora).

General Geology: Previous regional mapping was carried out toward the end of the nineteenth century by Lawson (1888). The regional geology as shown on the Kenora-Fort Frances Sheet (Davies and Pryslak 1967) concurred essentially with the findings of this survey party.

Bedrock is of Archean and Proterozoic age. The Archean rocks consist of a volcanic assemblage that had been intruded by a series of plutonic rocks; these are crosscut by diabase dikes of assumed Proterozoic age.

The thick metavolcanic assemblage underlies more than one-third of the area, occupying a belt about 5 miles in width and extending northeast-southwest. On the northwestern flank of the belt, a lower mafic sequence, comprised of massive lava, porphyritic basalt, and pillow lava near its base, and a mixed sequence of massive lava, pillow lava, porphyritic lava, and pyroclastic rocks toward the top, may be as much as 15,000 feet thick. All pillow tops observed face southeast. This mafic sequence is intruded by numerous quartz-feldspar and quartz porphyry dikes. An upper sequence of mixed mafic to felsic metavolcanics outcrops extensively on the shores of Burditt and Off Lakes in the centre of the belt. Felsic to intermediate metavolcanics consist of fine to coarse pyroclastic rocks, quartz porphyry, and minor dacite and rhyolite. Mafic metavolcanics consist of thin massive and pillow lavas; no top determinations could be made. Another narrow mafic unit is on the east flank of the belt.

Felsic to intermediate plutonic rocks, probably of several ages and all younger than the volcanic rocks, underlie less than two-thirds of the map-area. The volcanic belt lies between two plutons, the one in the northwest being trondhjemite, the one to the east being a heterogeneous monzonite to diorite complex probably of hybrid origin. Three stocks intruded the core of the volcanic belt: a porphyritic quartz monzonite body with a monzonite marginal zone; a heterogeneous monzonite-quartz monzonite-granodiorite body; and a quartz monzonite body east of Burditt Lake.

A northwest-trending swarm of diabase dikes, probably of Proterozoic age, crosscuts all other bedrock and postdates the major deformation.

Regional metamorphism under probable lower greenschist facies conditions in the centre of the volcanic belt appears to have increased to lower amphibolite facies conditions towards the edges. A broad migmatite zone is developed on the east flank of the belt.

Structural Geology: Insufficient facing criteria in the volcanic belt were gathered to determine a synclinal axis. However, such an axis possibly lies in the sequence of mixed felsic to mafic metavolcanics so that the mafic metavolcanics are on the west and east limbs of a synclinorium.

Intrusion of the three stocks probably postdated the major deformation. The distribution of coarse felsic pyroclastic rocks around the stock east of Burditt Lake indicates its possible emplacement into a volcanic vent.

Economic Geology: Copper-zinc mineralization would seem to be the most promising prospecting target in the volcanic belt. Several samples of felsic metavolcanics taken from outcrops where malachite staining and(or) chalcopyrite was present were submitted to the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, for analysis. However, none of these showed more than trace to low amounts of copper, and no zinc was detected. A sample of quartz porphyry taken by the author from a pit at the north end of Off Lake, close to the drill hole in which copper mineralization was found by A. Dunge in 1967, was found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 0.30 percent copper. A similar sample taken by the author from an outcrop stained with malachite at the north end of the east shore of Off Lake was found to contain 0.09 percent copper whereas a sample from a possible subvolcanic intrusion outcropping along Highway 615, about 1 mile south of Off Lake, was found to contain only 0.01 percent copper. A trace of copper was found in a sample of malachite-stained felsic volcanic rock taken from the southeast shore of Cedar Lake. Minor malachite staining and some chalcopyrite grains are in association with pyrite mineralization at a number of localities at the southern end of Burditt Lake and in the vicinity of Off Lake.

Pervasive green coloration in felsic metavolcanics heavily mineralized with pyrite in an outcrop on Highway 615 at the north tip of Off Lake was found on analysis by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to be due to fuchsite, a chromium-bearing muscovite.

Serpentinite was noted by Lawson (1888) at two localities in the map-area: at the northern end of Burditt Lake, and extending out of the map-area, is a serpentinized body containing brittle asbestos; on the south shore of South Bay of Lake Despair, in the southeastern part of the map-area, Lawson (1888) noted a large serpentinized body, but only a small outcrop was found by the author. In addition to these localities, talc schist was found close to the south shore of Spring Lake, just north of Off Lake. No sulphide mineralization was found in association with any of these bodies, and all are small and localized.

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No. 9 McCUBBIN, POISSON, AND McGILLIS TOWNSHIPS

(SAVANT LAKE AREA)

DISTRICT OF THUNDER BAY

by

W.D. Bond[1]

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Location: McCubbin, Poisson, and McGillis Townships lie in an east-west trend across the southern part of Savant Lake, which is located approximately 160 miles north-northwest of Thunder Bay. The town of Savant Lake is approximately 14 miles south of the map-area on Highway 599, which runs north from Ignace, passing through McCubbin Township. The three townships have an area of approximately 108 square miles.

Mineral Exploration: The area has previously been mapped at a reconnaissance scale by Moore (1928) and Skinner (1969). The most detailed study to date was done by Rittenhouse (1936).

Savant Lake has had a long history of intermittent mineral exploration. It was the search for precious minerals such as gold that attracted and received the attention of the early prospectors. According to Moore (1928), the earliest records show that gold was first discovered around the turn of the century if not before.

Interest in the area was enhanced when, a few years later, extensive iron deposits were discovered to the west of the lake. However, gold continued to be a much sought-after mineral.

In 1926, the first significant gold discovery was made on a small island in Savant Lake. This discovery became known as the McRae-Simmons Property and is described by Moore (1929, p.76-77). During 1940, the area was again brought into prominence when favourable assays for gold started another gold rush and extensive staking was done by numerous companies. This last rush was well documented in the September issue of the Northern Miner that same year. These discoveries proved to be uneconomic.

More recently sulphides associated with metavolcanics and iron formation have become the main target for exploration companies. The area around the southwestern part of McCubbin Township has received considerable attention for its iron reserves. Work began as early as 1908 when nine pits and two shafts were dug. Pershland Gold Mines Limited eventually acquired the property from a syndicate and did some trenching and diamond drilling in 1956. This was followed up with a magnetometer survey and further diamond drilling in 1957 and 1965. The property was optioned to The Algoma Steel Corporation Limited who conducted a magnetometer and geological survey of the area in 1967. The Algoma Steel Corporation also conducted a ground magnetic and detailed geological survey on 11 claims in Poisson Township in 1967.

The International Nickel Company of Canada Limited controls a large block of claims in McCubbin Township and during the summer of 1967 and 1968 sunk 14 diamond drill holes.

In 1969, a ground magnetometer survey was carried out on a group of 12 claims in Poisson Township for Morris Caddell and Associates.

In 1970, Dome Exploration (Canada) Limited staked 61 claims in McGillis Township and drilled eight holes for a total of 2,546 feet.

During the 1971 field season, several companies were active in the area. Noranda Exploration Company did a geological survey on a group of claims on Girard Island in Savant Lake. Morris Caddell conducted a more detailed geophysical survey at 200-foot intervals on the previously mentioned claims.

Mid-North Engineering Services Limited in conjunction with four other companies undertook an extensive geophysical survey of a large group of claims encompassing southern McGillis Township and much of the township to the south.

General Geology: All the consolidated rocks in the area are of Precambrian age. The area is characterized by a thick sequence of Keewatin-type metavolcanics and Timiskaming-type metasediments. These rocks have been intruded by small bodies of metagabbro and by granitic stocks.

Metavolcanics underlie the greater part of McGillis Township and the northern part of McCubbin Township. These include predominantly mafic to intermediate pillow lavas with medium- to coarse-grained interflows. The pillow lavas are estimated to make up about 70 percent of the sequence. In general, they are massive and poorly formed making top determinations difficult. Porphyritic varieties are common, often associated with the more massive interflows, and could be intrusive in part.

A metasedimentary belt of appreciable thickness extends westward from Savant Lake through Poisson Township and the southern part of McCubbin Township. Structurally the metasediments are very complex and are composed of interbedded greywacke, argillite, siltstone, abundant iron formation, and cherty sedimentary rocks.

A heterogeneous conglomerate, interfingered with tuffaceous metasediments and(or) pyroclastic rocks exists between the metasediments and metavolcanics in McCubbin and Poisson Townships. At its widest extent, the conglomerate-pyroclastic unit is 1-1/2 miles thick or more. In general, the pyroclastic part of the conglomerate increases eastward.

Several late dikes of metagabbro have intruded the metasediments.

Granitic to granodioritic masses, probably representing more than one igneous event, have intruded the metavolcanics and metasediments. Massive to foliated and even-banded biotite granitic rocks are found in the western part of McGillis Township. A massive, strikingly porphyritic granodiorite pluton north of Whimbrel Lake contains megacrysts of plagioclase feldspar averaging 2 inches or more in cross-section. Zoning can often be recognized in many of the phenocrysts. A large granite-granodioritic stock north of Kashaweogama Lake has been affected by faulting and is believed to be older than the other granitic rocks in the area.

Structural Geology: Moore (1928), Rittenhouse (1936), and Skinner (1969) have recorded the most dominant feature in the area as being a great synformal structure in the metasediments. This structure is much more complex than first thought in that top determinations indicate the area has been subjected to several periods of deformation.

Stratigraphically, the metasediments are remote from the metavolcanics, the two being separated by faults. A major fault goes through the centre of Savant Lake. To the east, the metavolcanics trend east to northeast and form part of a homoclinal structure with tops to the northwest. Further east, the metavolcanics are deflected around the granitic stocks. Another fault exists near the metavolcanic-metasediment contact in Poisson and McCubbin Townships.

From here the metavolcanics to the north form a broad, curvilinear east-west trend with tops to the north.

The largest displacement due to faulting occurs just north of Kashaweogama Lake where a series of transverse faults involving both lateral and rotational components have offset the conglomerate. Several transverse faults also exist in the northeastern part of Savant Lake and are contemporaneous with the folding.

The metasediments have been affected to a great extent by folding. Evidence from top determinations indicates that the metasediments were first tilted and folded isoclinally about east-west axis and, subsequently, refolded assymetrically about an east to northeast axis. Faulting coincidental with the folding produced further complications that remain obscure due to the heavy drift cover. Axial plane cleavage is well developed throughout the metasediments and trends approximately N70E.

Economic Geology:

Gold: The occurrence of gold in the area has been well documented by Moore (1928). The gold is invariably associated with numerous secondary quartz veins in shear zones throughout the area. During the field season, several were sampled and subsequent assays by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, revealed only traces of the precious metal.

Visible gold was found in selected hand specimens from the workings of several test pits on a small island southeast of Girard Island. This area was previously mentioned as the McRae-Simmons Property. The gold is associated with a quartz vein in a vertical shear zone extending N25W to N70W for about 2,000 feet through several islands. The quartz vein varies in width from about 6 to 18 inches; the shear zone itself is about 20 feet wide. Pyrite and chalcopyrite as well as gold are present in the vein.

Whereas some of the quartz veins appear to be completely barren, many of the veins contain pyrite, marcasite, chalcopyrite, and malachite. The quartz veins are discontinuous and, for this reason, have remained uneconomic.

Iron: Iron formation, present in only minor quantities in the metavolcanics, is abundant where associated with the metasediments. The iron formation is Algoma-type and characterized by bands or laminae of chert and magnetite alternating with greywacke or argillite.

The percentage of iron formation to greywacke and argillite appears to vary randomly throughout the area. Nevertheless, the areas of highest iron formation concentration are reasonably well defined by the highs on the regional aeromagnetic maps (ODM-GSC 1961a; 1961b) and occur along the western shore of Savant Lake and near the southwestern part of McCubbin Township, south of Kashaweogama Lake, the latter occurrence having the best potential. In some parts of these areas, as much as 65 percent of the exposure consists of iron formation. According to Shklanka (1968), up to 270 feet of almost continuous iron formation has been intersected by diamond drilling and as much as 500 million tons of open-pit reserves have been indicated by magnetometer survey, with samples indicating 33.6 and 37 percent iron.

It is difficult to evaluate the true thickness of the iron formation due to the amount of deformation, as numerous minor isoclinal folds were found during the course of the field work.

Sulphides: Pyrite is the most common sulphide found and occurs as disseminations widely distributed throughout the metavolcanics. Pyrite, pyrrhotite, chalcopyrite, arsenopyrite, marcasite, and copper-staining are found concentrated along shear zones.

The most spectacular occurrence of massive sulphides is exposed in several test pits and strippings in an east-west-trending shear zone located just west of Highway 599 about 1/2 mile north of Wiggle Creek. Pyrite, pyrrhotite, arsenopyrite, and minor chalcopyrite are found in a host of iron formation and metasediments. The sulphide zone, marked by rusty weathering and by quartz and carbonate stringers, is exposed for approximately 100 feet. The zone is approximately 2 feet wide at its thickest point. The quartz vein, with which the sulphides are associated, can be traced for at least 1/4 mile and minor amounts of sulphides are found elsewhere along it. A major transverse fault occurs in the immediate vicinity.

Pyrite, mostly euhedral in form, along with chalcopyrite, is exposed in four test pits and three strippings near the east shore of a small lake just west of Savant Lake. The sulphides occur along with quartz in a shear zone and are associated with iron formation and greywacke. The shear zone is exposed for 250 feet and trends approximately north-south. The main exposed sulphide zone is 5 inches wide and can be traced for 15 feet. No visible gold was seen although it was reported by Northern Canada Mines Limited (Northern Miner 1940) to be present.

Chalcopyrite and marcasite were found in a northwest-trending quartz vein situated approximately 1 mile east of central Savant Lake in McGillis Township. A selected sample analyzed for copper by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, was found to contain 0.14 percent copper. The quartz vein is 2 feet wide and could not be traced for more than 40 feet.

Sand and Gravel: Extensive sand and gravel deposits are in McCubbin Township and there are numerous pits along Highway 599. In addition, numerous moraines trending northwest are to be found in Poisson Township and both of these areas will no doubt prove to be of considerable value for the construction industry in the future.

Suggestions to Prospectors: Both the margins of the granitic stocks and the numerous faults represent favourable sites for ore deposition and should be prospected for further mineralization.

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No. 10 QUEST LAKE-STURGEON LAKE AREA

DISTRICT OF THUNDER BAY

by

N.F. Trowell[1]

Location: The Quest Lake-Sturgeon Lake map-area is bounded by longitudes 90°36' and 90°57'W and latitudes 49°55' and 50°00'N; it covers approximately 120 square miles. The area is located approximately 45 miles northeast of Ignace, and is in the District of Thunder Bay, and in the Patricia Mining Division.

Mineral Exploration: With the discovery in 1969 and 1970 of two base metal sulphide orebodies in the Sturgeon Lake area on properties now held by Mattabi Mines Limited and New Brunswick Uranium Metals & Mining Limited, the entire Quest Lake-Sturgeon Lake area, except for the eastern granitic portion, has been intensively prospected. Magnetic and electromagnetic surveys, both air and ground, have been done by several companies over their respective properties. A limited amount of diamond drilling has been carried out by these companies but as yet no significant mineralization has been reported.

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General Geology: Archean metavolcanics and metasediments and associated intrusions of ultramafic, mafic, and intermediate rocks underlie a large part of the western and central parts of the area.

The mafic to intermediate metavolcanics exposed between Sturgeon Lake and Sixmile Lake consist of an assemblage of fine- to coarse-grained flows, pillowed and amygdaloidal flows, and minor tuff units all metamorphosed under greenschist facies conditions. Intercalated with these units are felsic metavolcanics consisting predominantly of pyroclastic rocks and flow breccias. On and north of Sixmile Lake, intrusions of dioritic to gabbroic composition occur. They locally intrude thin bands of felsic metavolcanics. Quartz, quartz-feldspar and feldspar porphyry dikes cut all of the above units.

A similar metavolcanic assemblage is present north of Post and Barge Lakes between Sturgeon Narrows and Quest Lake. In addition, ultramafic rocks, dominantly serpentinized peridotite, have intruded the mafic metavolcanics and intermediate fragmental rocks in this area. The author believes that this area might represent the site of a former volcanic centre.

Timiskaming-type metasediments are exposed on Sturgeon Lake, at Sturgeon Narrows, and in the Quest Lake-Princess Lake area. Lithological differences indicate both different environments of deposition and different source areas for the metasediments of the respective areas.

A body of syenitic to monzonite composition underlies the eastern part of the area where it has intruded the metasediments and associated iron formation.

An alkaline complex is exposed along Sturgeon Narrows and in the north-central portion of the area. The outer margin of this body is composed of coarse-grained to pegmatoid alkalic syenite. The texture and mineral content, nepheline, sodalite, and scapolite, of the north-central part of this body indicates the presence of several undersaturated phases, perhaps having a zonal or ring-complex configuration. A carbonatite occurrence with associated fluorite and strontianite mineralization is reported by W.G. Wahl (personal communication) to occur on his property in Sturgeon Narrows.

Structural Geology: The presence of an alkaline complex and a possible carbonatite occurrence along Sturgeon Narrows shows that the Narrows might represent the site of a former rift structure. Faults trending in a north-east direction are indicated along the north shore of Sturgeon Narrows by relatively intense shearing and a number of topographic lineaments.

Folding and possibly cross folding is indicated in the central part of the area by the wedge-shaped configuration of the metavolcanic and metasedimentary assemblages.

Economic Geology: While the author is as yet undecided whether there is a carbonatite body at Sturgeon Narrows or whether there is only a carbonatized zone possibly associated with a major fault, the presence of fluorite, strontianite, and trace amounts of rare earths reported in diamond drill hole logs submitted to the Ontario Department of Mines and Northern Affairs for assessment credit by W.G. Wahl Limited, and the author's observations that fluorite occurs as interstitial disseminations in the alkaline rocks exposed on Seaton Island and in the north-central part of this complex, indicates that this complex should be prospected in detail. The author also observed small local concentrations of apatite, often with accompanying magnetite, perhaps indicative of the apatite-magnetite segregations often found associated with alkaline complexes. Detailed geological and magnetometer surveys would be required to pinpoint any such possible segregations. Pyrochlore mineralization is another possibility to be considered in prospecting this body.

The ultramafic rocks should be evaluated as to their copper, nickel, and cobalt contents. Several grab samples of these rocks were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, and gave .10 percent nickel but only trace amounts of cobalt and copper. The contacts between these ultramafic bodies and the metavolcanics should be accurately located as they are potential sites for sulphide mineralization. Detailed magnetometer surveys would serve to determine the exact configuration of these bodies and perhaps help in determining their stratigraphic and structural position.

The sheared, sericitized, hematitized, and carbonatized felsic metavolcanics in the western part of the area should be considered as possible sites for gold mineralization and prospected accordingly.

Major emphasis should be placed on the contacts between the felsic and mafic metavolcanics as possible locations for base metal sulphide mineralization. Special attention should be concentrated in those areas where the felsic metavolcanics thicken or "dome" and where there is appreciable wall-rock alteration. Sulphide mineralization is ubiquitous in the felsic metavolcanics in this area. One to two percent pyrite, commonly along with minor pyrrhotite and trace amounts of chalcopyrite occur as disseminations and stringers in these rocks.

No. 11 BARBARA, MEADER, AND PIFHER TOWNSHIPS

DISTRICT OF THUNDER BAY

by

W.O. Mackasey[1]

Location: Barbara, Meader, and Pifher Townships are located on the east side of Lake Nipigon and form part of the "Sturgeon River Gold Belt". Mapping of the area was commenced during the 1970 field season, during which time Barbara Township and parts of Meader Township were mapped. Pifher Township and the remainder of Meader Township were mapped during the 1971 field season.

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Highway 11, a line of the Canadian National Railways, and the natural gas pipeline of Trans-Canada Pipe Lines Limited pass through the town of Beardmore, which is about 10 miles south of the map-area. Meader and Pifher Townships are accessible by means of bush roads, but Barbara Township is best reached by boat or fixed-wing aircraft. A 3,000-foot, compacted-gravel airstrip is located nearby at Jellicoe. The city of Thunder Bay is located 120 miles to the southwest of Beardmore via Highway 11.

Mineral Exploration: Gold was discovered near Twin Falls, Irwin Township, just south of the southwestern corner of Pifher Township, in 1931. In 1934, Rene Maloney (Laird 1936, p.108) discovered gold in the southwestern part of Pifher Township. This promoted a staking rush in the same year. The Sturgeon River Gold Mine, Irwin Township, close to the southeastern corner of Pifher Township, was discovered during this rush and was in production from 1937 to 1942. Prospecting for gold has been continuous since the 1930s and is mainly concentrated in Pifher and Meader Townships. Algoma Development Company recently acquired the gold property, originally known as the "Neil Smith Showing" in central Pifher Township, and has established a small milling plant. The first gold brick was poured on the property in August 1971.

Search for base metals intensified in the 1950s and many sulphide showings have been examined in Pifher and southeastern Meader Townships since that time. Test drilling and trenching have recently been undertaken by J. Wodian and H.M. Holm in southeastern Meader Township and north of Miner Lake, Pifher Township. During the 1971 field season, Carling Copper Mines Limited conducted an IP survey in the vicinity of the former Norlex Mines Limited property, straddling the boundary between Pifher and Elmhirst Townships. A geological mapping program was started in September 1971. Phelps Dodge Corporation of Canada Limited conducted geological and geophysical surveys of a group of claims along the south border of Pifher Township in 1971. A short test-hole was drilled on this property during the field season.

Several exploration companies and individual prospectors were active in the area during the 1971 field season. A number of new sulphide occurrences were exposed by test pitting using a plugger.

General Geology: The oldest rocks in the area are Keewatin-type mafic, intermediate, and felsic metavolcanics. Granitic rocks with porphyritic phases and pegmatitic zones have intruded the metavolcanics and underlie most of the northern half of Meader Township. North-striking diabase dikes cut both the granitic and volcanic rocks. A flat diabase sheet overlies the volcanic rocks in southern Barbara and Meader Townships and a small outlier of diabase occurs at Peddle Lake in southwestern Pifher Township.

Intermediate to felsic tuffs, tuff breccia, and pyroclastic breccia with related flows underlie the southern part of the map-area. This unit continues westward to Lake Nipigon into an area previously thought to have been underlain by mafic volcanic rocks.

Mafic volcanic rocks, metamorphosed under amphibolite facies conditions, and consisting of flows with zones of pillows, amygdules, and breccia, form a unit paralleling the Lake Nipigon shoreline in the northern half of Barbara Township. Tuff breccia and related volcanic rocks occur in the northern part of Pifher Township. Some of these volcanic rocks have been metamorphosed under amphibolite facies conditions and have garnetiferous zones.

Sill-like bodies of fine- and medium-grained metagabbro, and lenses of feldspar porphyry, cut the metavolcanics throughout the map-area and are probably related to the volcanic activity. Granodioritic rocks intrude the metavolcanics near the boundary between Pifher and Elmhirst Townships.

Structural Geology: The volcanic rocks in the southern part of the map-area form part of an east-west fold belt. Foliation in the mafic volcanic rocks in Barbara Township trend northward and parallel the contact with the granitic rocks. The volcanic rocks in Pifher Township have been folded into a gently eastward-plunging anticline having a core of pillow lava overlain by thin-bedded tuff and minor flows, and a considerable thickness of tuff breccia and pyroclastic breccia. Metamorphism along the north limb of this fold has resulted in the development of amphibolite facies rocks that were previously classified as hybrid granites (Laird 1936).

Several east-trending faults cut both the metavolcanics and diabase. Northeast-striking linears are present in the granitic rocks.

Economic Geology: Sulphide mineralization is widespread in the map-area and is essentially confined to volcanic rocks and related gabbroic intrusions. Sulphides are present in shear and fracture zones such as at the Holm Property (Mackasey 1970) and north of Miner Lake on the former Greenoaks Property. Pyrite replacement deposits occur on the east side of the latter property and appear to be associated with a granodiorite contact. Tyson (1965) reports that the average grade of two channel samples across a seven foot width from the "Discovery pit" on the former Greenoaks Property, about 1-1/2 claims northwest of Miner Lake, is 1.28 percent copper and 0.63 ounces silver per ton. This mineralization occupies northeast-striking, steeply dipping fractures in metavolcanics.

Copper, zinc, silver, and gold mineralization is present on the former Norlex Mines Limited Property in sheared and silicified metavolcanics in Elmhirst Township (Assessment work files, ODMNA, Resident Geologist's office, Thunder Bay). Carling Copper Mines Limited is presently testing the extent of this mineralization in the vicinity of the boundary between Elmhirst and Pifher Townships.

Disseminated pyrite, chalcopyrite, and pyrrhotite mineralization is present in felsic metavolcanics in the eastern and southeastern parts of Pifher Township. Tourminalization in the form of stringers, finely disseminated crystals, and apparent replacements is closely associated with the copper mineralization in some locations.

Laird (1936, p.108) describes the Maloney Sturgeon Property in southwestern Pifher Township as being a gold-quartz vein in pillow lava and states that cobbed material taken from 40 tons of vein matter reportedly yielded a 21.4 ounce gold brick. In 1937, 73 ounces gold and 16 ounces silver worth $2,549 were produced from one ton of vein material (Statistical files,ODMNA, Toronto).

The gold-quartz vein on the Algoma Development Company Limited property, Pifher Township, is two to three feet wide and can be traced along its easterly strike for approximately 200 feet. The vein contains irregular splashes of chalcopyrite and abundant native gold. Halladay (1966) states that sampling of the northeastern part of the vein indicated an average grade of 5.8 ounces gold per ton and 3 percent copper over an average width of 20 inches along a strike-length of 152 feet.

The porphyritic "greenspar" diabase in central Pifher Township that has been considered for building stone is part of a north-south dike that extends through the township. A high concentration of altered feldspar phenocrysts in the "development area" has produced a rock which, when cut and polished, is very pleasing to the eye. Although initial development was apparently aimed at the building stone industry, consideration should be given to a small-scale operation for the production of decorative stone, such as might be used in bookends and lamp bases. Prohibitive features such as jointing and fracturing in the dike must first be evaluated.

A quartz vein about 1,700 feet long on the east side of the porphyritic diabase dike in Pifher Township has been considered for use as an aggregate material. Samples from this vein have been collected by the field party for testing of undesirable features, such as sulphide mineralization.

The northern part of Pifher Township is underlain mainly by metavolcanics rather than hybrid granitic rock as previously believed. Prospecting in this part of the map-area may therefore be warranted.

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No. 12 NORTHERN HALF OF McTAVISH TOWNSHIP

DISTRICT OF THUNDER BAY

by

W.H. McIlwaine[1]

Location: McTavish Township is about 35 miles northeast of Thunder Bay. Good access is provided by Highway 11-17 from which there are several branch roads and trails.

Mineral Exploration: During the latter part of the nineteenth century, prospecting was directed towards finding galena and sphalerite-bearing quartz-carbonate veins associated with the nonconformity between granitic rocks and the overlying Sibley sedimentary rocks. These veins are locally rich in lead and zinc, but were found to be too limited in extent to be economic. A few hundred dollars worth of ore was taken from the Enterprise and Caribou Mines. A detailed study of these mineral deposits has recently been made by Franklin (1970).

A molybdenite occurrence along the east shore of Anderson Lake in Sections 4 and 5, Concession VIII, has been examined on several occasions. Test pitting and trenching was done in 1918 (Johnston 1968, p.70). In 1958 and 1959 work done by Lindsay Explorations Limited (now Sapawe Gold Mines Limited) included stripping along a 2,200-foot zone and about 50 test pits and trenches were blasted along this zone. A diamond drill program of 18 holes totalled 2,114 feet. A 2,000-pound bulk sample was also collected from the pits; 100 pounds were taken from each of 20 pits. The samples varied in grade from 1.41 percent to 4.63 percent molybdenum with an average of 2.85 percent molybdenum (Ingham 1966).

The occurrence was optioned by Briar-Court Mines Limited who, in 1967, drilled 20 holes totalling 1,006.2 feet.

A copper occurrence in Location A was pitted and drilled, in 1967, by R. Barker. Thirteen holes totalling 1,825 feet were put down across a breccia zone along the granite-Sibley nonconformity. Further bulldozing and stripping was done, in 1970, by E.J. Williamson the present holder.

In the last decade the main exploration concern has been amethyst deposits. Thunder Bay Amethyst Mining Company Limited produces amethyst from two small, nearly connected open pits in Section 4, Concession VI. Other amethyst production comes from pits held by G. Noyes in Section 4, Concession IV and by N. Dzuba in Location 5.

Both the east and west pits of Thunder Bay Amethyst Mining Company Limited were extended during the summer, and both resulted in finding good new vugs of amethyst, especially in the west pit.

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General Geology: The area was previously mapped by Hawley (1929). The oldest rocks in the area are in a 1.5 square-mile fault-bounded, subrectangular block to the east of Anderson Lake; the rocks are predominantly metasediments and migmatitic metasediments. The metasediments are commonly quartz-biotite schist and foliated quartz-rich amphibolite.

This assemblage has been intruded by plutonic rocks of granitic composition which underlie most of the northern part of the map-area. The granitic rocks are quartz monzonite in composition and range from massive to weakly foliated and equigranular to porphyritic. Most of the rocks are biotite-bearing with muscovite-bearing rocks found less commonly. Biotite-muscovite phases were mapped locally. Inclusion-rich zones are common; xenoliths are mainly biotite schist and locally have been rotated. Simple pegmatite dikes are ubiquitous.

The granitic rocks are overlain by the Sibley Group of sedimentary rocks. The term "group" is used here inasmuch as it is well known in the literature and it is anticipated that future detailed work may result in the Sibley divided into formations. Two stratigraphic units are in the northern half of McTavish Township. The lower unit consists of a localized basal conglomerate or breccia and overlying sandstone. This is overlain by a unit consisting of interbedded muddy sandstone, siltstone, and intraformational conglomerate and breccia.

The conglomerate clasts are nearly all granitic in composition and range from pebbles to boulders which are angular to rounded. Locally there is little or no matrix, but where matrix is present, it is commonly red and sandy. About 2 miles north of the hamlet of Pearl the conglomerate has a thickness of 30 feet, the greatest thickness found.

The overlying sandstone is fine grained, feldspathic, and grey to buff. The cement is commonly carbonate with local barite. The estimated thickness of the conglomerate-sandstone unit is 100 feet.

The three rock types of the overlying unit are all interbedded. They are all hematitic and therefore red. The sandstone is very fine grained and red with yellow spots up to 1 inch indicating areas of non-oxidation. The intraformational breccia and conglomerate is very chaotic in appearance and contains angular sandstone blocks up to 2 feet in diameter. This rock type is more common in the southern half of the township. The thickness of this unit has not yet been determined.

Intruding these older rocks are sheets and dikes of Logan-type diabase. The rocks mapped to date consist of fine- to medium-grained gabbro.

Pleistocene deposits consist of till, boulder till, sand, and clay. Good crossbedding is locally present in the sand deposits.

Structural Geology: Foliation in the granitic rocks is generally weak but, where present, has an east to northeast strike with steep dips. The schistosity in the metasediments has a similar attitude.

Regionally, the Sibley strata have a gentle southeast dip; locally, however, the bedding attitudes are not consistent. This is mainly due to the influence of the underlying granitic rocks. Dips are mostly from 5 to 15 degrees.

Three main fault directions are east, northeast, and north. The vein system at the Thunder Bay Amethyst Mine is in an east-trending fault zone.

A prominent fault zone trends northeast from Section 6, Concession VIII, through the township. It is marked by a steep scarp with silicification, brecciation, and local changes in rock type from one side to the other. Silicification is present along other fault zones.

Economic Geology: Lead-zinc-bearing quartz-carbonate veins are associated with the Sibley-granite contact; the veins are generally in a brecciated zone. Mineralization includes galena, sphalerite, with subsidiary amethyst, chalcopyrite, pyrite, chalcocite, barite, and reports of gold and silver from the Enterprise Mine (Tanton 1931, p.168). These deposits are rich but very small. Tanton (1931) reports values up to 41.84 percent lead at the Enterprise Mine.

The amethyst deposits are in veins in or near granitic rocks. Some of these deposits are associated with the base of the Sibley Group. The G. Noyes occurrence 2 miles northwest of Pearl is one such deposit, as is that of N. Dzuba in Location 5. Although Sibley conglomerate is present in the pit at the Thunder Bay Amethyst Mine, the vein system is not apparently along the contact but strictly in the granitic rocks. Sulphide mineralization is more common in the occurrences at the contact and includes galena, sphalerite, pyrite, and chalcopyrite.

The amethyst is deep purple and some crystals are coated with hematite. Kustra (1969, p.46) published analyses of white and purple quartz from the Thunder Bay Amethyst Mine. The results indicate the colour is due to iron which in the white quartz was 150 ppm whereas there were 500 ppm in the purple quartz.

There are two ages of quartz veins; early, massive quartz veins are cut by later amethystine quartz veins.

The molybdenite mineralization east of Anderson Lake is associated with a north-trending pegmatite dike cutting migmatitic metasediments. The mineralization occurs as local high-grade pockets irregularly distributed along the dike (Ingham 1966). Higher concentrations are centred in areas of quartz enrichment which is either coarsely crystalline in the pegmatite or as irregular veins (Ingham 1966).

Sand and gravel pits have been developed close to Highway 11-17; these have been used mainly by the Ontario Department of Highways.

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No. 13 PLEISTOCENE GEOLOGY AND INDUSTRIAL MINERAL RESOURCES OF THUNDER BAY AND VICINITY

DISTRICT OF THUNDER BAY

by

G.J. Burwasser[1]

Location: The Fort William Map Sheet (NTS for 52A) extends from latitudes 48° to 49°N and from longitudes 88° to 90°W. The city of Thunder Bay is 10 miles west-southwest of the centre of the sheet. Detailed mapping was accomplished in the vicinity of the city of Thunder Bay on a scale of 1:25,000 between north latitudes 48°15' and 48°30' from west longitudes

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89°07'30" to 89°22'30" and in the vicinity of Hazelwood Lake on a scale of 1:50,000 between north latitudes 48°30' and 48°37' from west longitudes 89°07'30" to 89°22'30". Reconnaisance and less detailed mapping on a scale of 1:50,000 was extended into the area of Kakabeka Falls and the town of Kaministikwia between north latitudes 48°20' and 48°35' from west longitudes 89°22'30" to 89°45'00". Detailed studies of sites in several noncontiguous areas were conducted.

General Geology: The region is underlain entirely by Precambrian bedrock. South of the Kaministikwia River and Highway 588 the Proterozoic uplands are formed by Animikie Group argillite and greywacke capped with Keweenawan diabase sills. Near the shore and on several islands of Lake Superior a swarm of northeast-trending diabase dikes and erosional remnants of the diabase sheets (Logan Sills) produce palisades, some of which rise more than 1,000 feet above lake level. North of the river and highway is a 1- to 10-mile wide band of Animikie conglomerate, chert, carbonate, and argillite-tuff, collectively known as the Gunflint Formation, which in Ontario extends from Gunflint Lake to the Sibley Peninsula. It is overlain on the Sibley Peninsula by the Keweenawan Sibley Group of conglomerate, sandstone, and shale.

The remainder of the area north and west of the city of Thunder Bay is underlain by Archean felsic igneous and metamorphic rocks interrupted by an arc of metasediments and mixed metavolcanics and metasediments extending from Shebandowan Lake to Loon Lake.

In the immediate vicinity of the city of Thunder Bay, the bedrock is overlain by compact, fissile, red-brown, noncalcareous, silty till emplaced from the southeast. The lee side of the moulded bedrock knobs, aligned in an east-west direction, retain deposits of an older, sandier, less fissile till emplaced from the north. Paipoonge and Neebing Townships, the eastern part of McIntyre Township and the western part of Blake Township contain a sequence of postglacial deposits which vary in thickness from a few feet of beach gravel on an ancient erosional strandline to more than 40 feet of mixed lacustrine and fluvial sands, silts, and clays along the spillway-delta complex which extends from Kakabeka Falls to Lake Superior. Eight-foot-thick sequences of varved clays are exposed near the villages of Moose Hill and Rosslyn. The Rosslyn site contains an inch-thick layer of datable organic material between lacustrine clays. The remainder of Blake Township and Fort William Indian Reserve #52 contain thin till patches and discontinuous beach gravels overlying the bedrock surface.

North of Thunder Bay in Ware, Gorham, and MacGregor Townships there exists evidence for glacial advances from southeast, east, northeast, and north. In the area, there are tills of varying thicknesses and numerous outcropping bedrock knobs which have created disconnected depositional basins containing varved lacustrine sediments, proglacial outwash and ice-contact deposits commonly having a coarse gravel and cobble texture. Extensive ice-contact deltaic deposits are connected with the moraines near Hazelwood Lake.

Structural Geology: Dikes, faults, and lineaments in the area trend primarily toward the northeast and north-northeast with secondary trends to the southeast and south.

Economic Geology: The major source areas presently utilized for sand and gravel production are in the outwash deposits of Oliver, Paipoonge, McIntyre, and Neebing Townships and in the proglacial and ice-contact deposits of Oliver, Ware, Gorham, and MacGregor Townships. Diabase bedrock for crushing has been quarried from sills in McIntyre, MacGregor, and Neebing Townships. Shale for fill and road ballast has been taken from bedrock highs and wave-cut strandlines in McIntyre and Neebing Townships and from the Fort William Reservation. In the future, the proglacial and ice-contact deposits north of the city of Thunder Bay will probably form the major supply of aggregate in the area.

The 1969 production of sand and gravel was 5,398,945 tons valued at $2,271,272. Clay products from the lacustrine deposits were valued at $1,777,832 (Statistical files, ODMNA, Toronto).

No. 14 LANG TOWNSHIP AND TOWNSHIP 44

DISTRICT OF SUDBURY

by

Gerald Bennett[1]

Location: Lang Township lies at the southern tip of Missinaibi Lake about 45 miles northeast of Wawa and 35 miles northwest of Chapleau. Township 44 adjoins the western boundary of Lang Township. There are no roads in the area, and although canoe routes to some parts of the area exist, the most efficient means of access is by float-equipped aircraft.

Mineral Exploration: In 1970, four claims were staked by the Canadian Nickel Company Limited in northwestern Lang Township. Records submitted for assessment credit, on file at the office of the Resident Geologist at Sault Ste. Marie, indicate that two diamond drill holes, totalling 281 feet, intersected amphibolite with short sections containing up to 20 percent pyrrhotite with minor pyrite. Two of these claims have since been allowed to lapse.

In 1970, two blocks of 10 and 12 claims each were staked in northwestern Lang Township and registered under the name of Yvan Perrier. Records on file at the office of the Mining Recorder at Sault Ste. Marie indicate that electromagnetic and magnetometer surveys were carried out but the results are not yet available.

General Geology: Archean metavolcanics and associated metasediments underlie about 50 percent of Lang Township and about 20 percent of Township 44. The remainder of the area is underlain mostly by granitic rocks presumably of Archean age.

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The predominant metavolcanic rock is black, medium- to fine-grained amphibolite, consisting mainly of amphibole and plagioclase. Biotite, garnet, epidote, and magnetite are locally abundant. The amphibolite represents basaltic flows which have undergone regional metamorphism under upper greenschist and almandine-amphibolite facies conditions. An area of coarse-grained, massive amphibolite about 1 mile west of the south end of Missinaibi Lake may represent a metamorphosed gabbro body.

A unit of titaniferous magnetite iron formation can be traced from the Missinaibi River in northern Township 44 to central Lang Township, a distance of about 6 miles. Except where disrupted by faults, the iron formation is almost continuous and consists of one to three layers of massive titaniferous magnetite and ilmenite from less than 1 foot to about 85 feet thick, intercalated with zones of disseminated titaniferous magnetite which range from about 20 feet to as much as 80 feet thick.

The titaniferous magnetite iron formation occurs throughout its length in medium- to coarse-grained amphibolite and garnetiferous amphibolite. The titaniferous nature of the magnetite and its occurrence in what is probably a metamorphosed gabbro sill indicates that it is of magmatic derivation.

In the amphibolite assemblage, there are concordant, narrow, discontinuous units of intermediate to felsic metavolcanics, metamorphosed intrusions associated with the volcanic rocks, and sills of granitic rocks emplaced during the main period of granitic intrusion. Because of metamorphism, it is difficult to distinguish between these three rock types with any degree of certainty. Also intercalated with the mafic metavolcanics are fine- to medium-grained biotite-quartz-feldspar schists which are locally garnetiferous and probably represent recrystallized interflow sediments.

Banded iron formation is widespread in the northwestern quarter of Lang Township. Both oxide and sulphide facies rocks were recognized, but the units are generally only about 5 to 30 feet thick and seem to be discontinuous.

Although varied and complex, the granitic rocks of the area can be classified as either early, syntectonic granitic rocks or younger posttectonic types. The former make up most of the granitic terrane surrounding the metavolcanic belt and consist of strongly foliated biotite granite, pegmatitic biotite granite, leucocratic muscovite-bearing granite, biotite-quartz-feldspar gneiss, complex gneissic migmatite, and agmatitic migmatite. All of these granitic rocks form discrete bodies which are generally concordant with the metavolcanics, although in detail crosscutting relationships with the metavolcanics are present.

Posttectonic granitic plutons intruded the metavolcanics of northern Lang Township. These include foliated biotite granite and pink, porphyritic, biotite granite. These granitic rocks, particularly the latter, are more uniform and massive than the syntectonic granite rocks and display crosscutting relationships with the metavolcanics.

Numerous north-northwest-trending, north-trending, and northeast-trending diabase dikes intrude the granitic and volcanic rocks of the map-area.

Structural Geology: A satisfactory structural model of the metavolcanic belt could not be determined. Pillow structures in metabasalts in north-central Lang Township indicate that the metavolcanics form either a syncline or a homocline with younger rocks towards the west. Although pillow structures are elsewhere in the amphibolite assemblage, primary structures are too highly deformed for determining stratigraphic "tops".

A major fault trends southward from Ruby Lake along the west boundary of Lang Township to beyond Lang Lake in southwestern Lang Township. Displacement of the titaniferous magnetite iron formation and the metavolcanics indicate a left-lateral displacement of 4,000 feet. There is also evidence that this fault was synchronous with the intrusion of a porphyritic granite pluton around Ruby Lake, but was subsequent to the solidification of the syntectonic granites.

Lineaments on airphotographs indicate the possible presence of several northeast-trending faults. Two of these faults have been confirmed by the displacement of lithologic units. One northeast-trending fault parallels the south shore of Missinaibi Lake and another trends northeast from the south end of Lang Lake. Both have right-lateral displacements of 3,500 feet.

Economic Geology:

Iron: In 1959, Algoma Ore Properties Limited staked 39 claims in northwestern Lang Township over a part of the zone of titaniferous magnetite iron formation previously referred to. Geological mapping and a magnetometer survey were carried out over this iron formation between Lake Missinaibi and the west boundary of Lang Township. Four drill holes, totalling 1,005 feet, were drilled in 1959. A report filed at the Ontario Department of Mines and Northern Affairs Resident Geologist's office, Sault Ste. Marie, by an Algoma Ore Properties Limited geologist, states that the most interesting occurrence is near the southwest shore of Missinaibi Lake where three high-grade sections totalling 140 feet with between 35 percent and 50 percent soluble iron are intercalated with two low-grade sections of disseminated magnetite with a total thickness of 135 feet containing less than 35 percent iron. The report states that 16,000,000 tons averaging about 35 percent soluble iron are in this occurrence. Analytical results given in the report show that high-grade samples commonly contain 10 to 15 percent TiO_2 and 0.01 percent phosphorous. Six surveyed claims covering the iron formation are held by The Algoma Steel Corporation Limited, but there is no record of work done since 1959.

Molybdenite: A few small flakes of what is tentatively identified as molybdenite were found in foliated biotite granite by one of the author's assistants during the 1971 field season. The occurrence is located 11,400 feet west of the east boundary of Township 44 and 2,750 feet north of the south boundary of that township. The molybdenite occurs along narrow fractures, and seems to be restricted to a few square feet on a vertical outcrop face.

Sulphides: Limonite-stained, granular, silicious rocks in northwest Lang Township commonly contain finely disseminated pyrite, and in a few places narrow lenses of pyrite a few feet long, but no economic mineralization. The rock is probably a sulphide facies iron formation.

Disseminated sulphides are rare in the amphibolite but a few blebs of pyrite from 1/8 to 1/4 inch in diameter occur with titaniferous magnetite iron formation about 1 mile southwest of Ruby Lake in Township 44.

No. 15 KEITH-HORWOOD AREA

DISTRICT OF SUDBURY

by

V.G. Milne[1] and F.W. Breaks[1]

Location: The map-area is bounded by latitudes 48°07' and 47°56'N and by longitudes 82°24' and 82°31'W. It is approximately 120 square miles in area, of which 25 square miles are covered by water. Access to the Horwood Lake area is by an Ontario Department of Lands and Forests public access road, via Highways 101 and 616. The southeast part of Horwood Township is accessible by a secondary road which passes through the Kukatush station site and thence to Highway 101. The Canadian National Railways passes very close with stations at Tionaga, Kukatush, Groundhog River, and Foleyet. Detailed mapping was done at a scale of 1 inch to 1/4 mile.

Mineral Exploration: Discovery of iron formation north of Groundhog Lake and in the Woman River area to the south of Horwood Lake in the early part of this century initiated interest in the map-area. Gold was the next metal to be sought, with activity reaching a peak during the 1930s. Numerous properties with gold mineralization in quartz veins and shear zones were developed at this time. In 1936, a shaft was driven to an inclined depth of 600 feet in order to explore a quartz vein which showed promising trench gold values. This property, known as the Smith-Thorne group, was optioned by Hollinger Consolidated Gold Mines Limited in 1936, but dropped in 1938 owing to disappointing subsurface values. Discovery of the Joburke Gold Mines Limited (now New Joburke Explorations Limited) gold property in northern Keith Township in 1946 once again stimulated interest in the area with many properties being actively explored. In 1948 and 1949 Orofino Mines Limited undertook subsurface exploration on its claim group, located in southwest Horwood and southeast Silk Townships, in order to evaluate gold-quartz veins in a sheared diorite stock. A shaft was sunk 306 feet with levels opened at vertical depths of 150 feet and 275 feet.

Although considerable prospecting, trenching, and diamond drilling have been carried out in the past, no producing gold mine was discovered. Recent times have recorded negligible mineral exploration activity in the map-area.

General Geology: The map-area is in the northern part of an arcuate-shaped metavolcanic-metasedimentary belt (Ayres *et al.* 1971), which is almost entirely in the Sudbury District. All rocks, with the possible exception of some Late Precambrian diabase dikes, are of Archean age. Mafic metavolcanics greatly predominate and, together with minor felsic metavolcanics, comprise the oldest rocks. The mafic metavolcanics vary from massive, relatively undeformed, pillowed and(or) amygdaloidal rocks to highly sheared varieties. Mafic flow-breccias are common. Seven small, scattered felsic metavolcanic units were mapped in Horwood Township and a further two areas were delineated in southern Keith Township. The rocks of these units vary from tuff to pyroclastic breccia according to the size classification of Fischer (1966). A granitic mass in Keith Township, previously interpreted to be the westerly terminus of a bulbous hornblende granodiorite pluton prominent in Penhorwood Township, now seems to be a subvolcanic intrusion. The presence of felsic pyroclastic rocks intimately associated with the fine-grained, pale grey-weathering, biotitic granitic rocks, and the presence of a porphyritic texture and miarolitic cavities in the latter, lends credence to this supposition. The complex of felsic pyroclastic and intrusive granitic rocks has been extensively migmatized by injections of hornblende granodiorite.

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[1] Geologists, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Sparse sandstone to conglomerate occur in places in the metavolcanic sequence.

Medium- to coarse-grained hornblende-plagioclase rocks, mapped as amphibolite, are widespread, particularly on Horwood Peninsula. Many of the larger bodies display intrusive relations with the host mafic metavolcanics and are considered to be early metagabbroic plutons, possibly consanguineous with an epoch of mafic volcanism.

Several small bodies of serpentinized ultramafic rocks were mapped. Most of these appear to be spatially related to the Hardiman Bay Fault. They predate the late granitic rocks in the map-area.

Four types of granitic plutonic rocks have intruded the metavolcanic sequence: (1) foliated biotite to hornblende trondhjemite, (2) massive hornblende and(or) biotite granodiorite, (3) massive porphyritic biotite quartz monzonite, (4) massive diorite. Feldspar and(or) quartz porphyry dikes and sills are common although age relations to other felsic intrusive rocks are presently nebulous.

Diabase dikes and sills intrude all the aforementioned lithologies.

Structural Geology: Foliate structures, often schistose and less commonly gneissic, constitute the most widespread penetrative features. Generally, the trend of the foliation is northeast-southwest with steep dips toward the northwest. Disparities arise contiguous to the three largest granitic plutons. There, the foliation trends are concordant with the margins of the plutons and may be related to a dilatant upwelling of granitic magma. Three faults, in addition to several lineaments, were recognized: (1) Hoodoo Lake Fault, a north-south-trending fault with a right-lateral displacement of at least 4,000 feet; (2) Hardiman Bay Fault, a northeast-trending fault with only minor right-lateral movement; (3) a northwest-striking transcurrent fault near the east-central boundary of Horwood Township.

Economic Geology: Disseminated pyrite and(or) pyrrhotite are ubiquitous in the mafic metavolcanics. Sparse, disseminated chalcopyrite was also noted in a few localities. In the felsic metavolcanics usually only minor quantities of sulphides are present. An exception is the occurrence of a 1-inch wide vein of fine-grained, grey pyrrhotite in a possible rhyolitic flow on the largest island in Horwood Lake; a few grains of chalcopyrite are also present here. A minor amount of chalcopyrite was found in a sheared porphyry located about 4,500 feet southeast of the Smith-Thorne Mine headframe on Horwood Lake. A few pods of chalcopyrite and pyrrhotite were in a small serpentinite stock at Hardiman Bay. A flow contact between felsic lapilli-tuff and massive, light green, mafic metavolcanics in south-central Horwood Township is mineralized with pyrite. The most interesting discovery recorded is the occurrence of molybdenite in a leucocratic, foliated, potassic granitic rock. This showing is considered to be a porphyry-type occurrence owing to the presence of K-feldspar phenocrysts and the widespread presence of quartz veins, the latter emplaced both parallel to foliation and along a joint set normal to the foliation. Mineralization consists of molybdenite and pyrite, either as small, disseminated grains or as small veinlets contiguous to the quartz veins. A grab sample was submitted for analysis to the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, and was found to contain 0.15 percent molybdenum.

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No. 16 MAGNETIC SURVEY OF LANGMUIR AND ELDORADO TOWNSHIPS

DISTRICT OF TIMISKAMING

by

Wooil Moon[1]

Location: Langmuir and Eldorado Townships are located about 7 miles southeast of Timmins, Ontario. The area of 72 square miles is bounded by latitudes 48°16'30" and 48°22'00"N and by longitudes 80°57' and 81°12'W. The northwestern and central parts of Langmuir Township are readily accessible by a road leading to the new Inco-Noranda mine. The access to the rest of the township is possible by helicopter and boat through Night Hawk Lake and Night

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Hawk River. The access to Eldorado Township is a little more difficult. The eastern half of the township is accessible by a lumber company dirt road. The western and southern parts of the township are best reached by helicopter.

Magnetic Survey: A vertical component magnetic survey of Langmuir and Eldorado Townships was carried out using one sharp MF-1-100 and two McPhar M 700 magnetometers. Diurnal changes in the earth's magnetic field were recorded to an accuracy of 10 gammas utilizing one of the McPhar magnetometers and a Rustrak Model 88 recorder, powered by a 12-volt automobile battery. Ground magnetic surveys filed with the Ontario Department of Mines and Northern Affairs by companies for assessment credit, as well as surveys donated to the project, were compiled using a common magnetic base-level in making the detailed magnetic map. The relative differences between company survey values and the present survey values were obtained by reoccupying a number of company stations, preferably in localities of low gradient. An arithmetic average of differences were applied to reduce the company surveys to an Ontario Department of Mines and Northern Affairs common base-level. The areas not covered by company surveys were traversed at 600- to 800-foot line intervals. Readings were taken at every 100 feet in low gradient areas, and at every 50 feet in high gradient areas. A compass-chain technique was used to run the survey and airphotographs at a scale of 1 inch to 800 feet were used to provide location control for the traverses.

Magnetic susceptibility measurements were done for all major rock types occurring in the survey area. About 200 susceptibility readings were taken from diamond drill core samples and about 100 were obtained on outcrops in the field using a Bison 3120 "in-situ" coil. Also, 50 susceptibility measurements were made on soil samples from the thick overburden area to aid the final interpretation of the magnetic maps. A resistivity survey (vertical profile only) was carried out in localities of heavy overburden to estimate the overburden thickness and the groundwater depth, as well as to obtain the ground resistivity data on the area. The purpose of this survey is to aid in the interpretation of the final magnetic map.

Mineral Exploration: Prior to the initial exploration for nickel by McWatters Gold Mines Limited in 1962, the area was prospected primarily for gold, found in iron formation and quartz veins. Mineral production was limited to barite which was mined intermittently from 1911 to 1948 in the southern part of Langmuir Township. Narrow asbestos veins are common in serpentinized ultramafic rocks. Since the discovery of nickel in 1964 by McWatters Gold Mines Limited, the major interest in the area has centred around the occurrence of nickel mineralization associated with the serpentinized ultramafic rocks. The discovery of a low-grade nickel deposit, presently being developed by Noranda Mines Limited, by The International Nickel Company of Canada Limited has attracted new exploration activity to the area. In 1971, claims in good standing covered the whole of Langmuir Township and most of Eldorado Township, except the southwestern part. The mining companies currently engaged in exploration are The International Nickel Company of Canada Limited, Noranda Mines Limited, and Canadian Jamieson Mines Limited. The International Nickel Company of Canada Limited was engaged in ground magnetic, ground electromagnetic, and other geophysical surveys in 1971. During the field season Canadian Jamieson Mines Limited carried out a diamond drilling program on the ground previously tested by McWatters Gold Mines Limited. Noranda Mines

Limited is completing a new shaft to develop the Noranda-INCO nickel deposit, and during the field season carried out geological surveys.

General and Structural Geology: The general and structural geology of the map-area has been described by D.R. Pyke (1969; 1971).

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No. 17 ELLIOTT, TANNAHILL, AND DOKIS TOWNSHIPS

DISTRICT OF COCHRANE

by

L.S. Jensen[1]

Location: The map-area comprises three adjoining townships totalling 102 square miles in the southeastern part of the District of Cochrane. The centre of the area is located 23 miles northeast of Kirkland Lake and 32 miles west-northwest of Noranda. Access to the western part of the area, Elliott Township, is by road southeast from Highway 101. The northeastern part of the area is accessible by canoe via the Magusi River from Lake Duparquet, Quebec. Dokis and Webster Lakes are suitable for float-equipped aircraft and provide access to the southern parts of Dokis and Tannahill Townships.

Mineral Exploration: Prospecting, mainly for gold, has been carried out intermittently since 1917 when gold was discovered to the north in Harker Township and to the south in the Larder Lake area. In the early 1920s pits and trenches were sunk in a locality 2,000 feet north of Ghost Lake, Elliott Township (Gledhill 1925). In the late 1930s, the property was restaked by G. Cameron who reopened the trenches and pits and sampled the property. Three short x-ray holes were diamond drilled during this period. In 1946, the property was examined by C.L. Heath of Heath and Sherwood Limited. In 1947, Sylvanite Gold Mines Limited optioned the property from G. Cameron and three diamond drill holes totalling 305 feet, were bored. In 1962, the property was restaked by I.C. Stairs and geologically mapped by H. Hanson.

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[1] Graduate student, Department of Geology, University of Saskatchewan, Saskatoon, Saskatchewan.

Gold was also discovered by V. Jordan in 1931 in the southwestern part of Tannahill Township and was subsequently staked for The Teck-Hughes Gold Mines Limited. Surface work consisting of pits and trenches was done and a winter road cut to the property prior to the lapse of the claims the following year. In 1935 the property was restaked by J.A.M. McClosky who optioned the property to Erie Canadian Mines Limited in 1936. The option was dropped the following year.

Evidence of other early prospecting is seen from pits and trenches sunk on quartz veins and pyrite-rich gossans in the area, presumably in search of gold.

Little or no work has been done in this area since 1963.

General Geology: All bedrock is of Archean age, except diabase considered to be of Keweenawan age. The bedrock consists of mafic, intermediate, and felsic volcanic rocks intruded by stocks and sills of gabbro, diorite, granodiorite, and syenite. Dikes of feldspar porphyry and diabase cut the volcanic rocks. Metamorphic effects, representing the greenschist facies, occur only along shear zones and near some intrusive contacts.

The volcanic rocks are part of a larger sequence of volcanic rocks on the north limb of a synclinorium, the axis of which is shown on Ontario Department of Mines and Northern Affairs,Preliminary Geological Series Maps P.629, P.692, and P.693. The lowest part of the sequence found in the map-area occurs in Elliott Township. It consists of alternating flows of mafic and intermediate volcanic rocks in which a few thin units of cherty felsic tuff and intermediate tuff breccia occur.

The upper part of the sequence occurs to the southeast in Tannahill and Dokis Townships. The volcanic rocks are predominantly intermediate flows interlayered with thick irregular pyroclastic units. The felsic volcanic rocks in the upper part of the sequence occur as subvolcanic dikes and sills.

The mafic volcanic rocks are massive and pillowed flows with a diabasic texture. Flow contact breccias containing variolites occur between the flows. The intermediate volcanic rocks, the most abundant rock type in the area, consist of massive, pillowed, and flow-breccia flows and agglomeratic and tuffaceous pyroclastic units. Felsic fragments are abundant in some intermediate pyroclastic rocks. The felsic volcanic rocks are fine light-coloured cherty units in the basalts and massive subvolcanic quartz-feldspar porphyries among the intermediate volcanic rocks.

Stocks and sills of fine- to coarse-grained gabbro and diorite occur throughout the map-area. Many show minor changes in composition as a result of magmatic differentiation. North of Webster Lake, one gabbro sill 1-1/2 miles long has an anorthositic phase.

Felsic intrusions consist of one stock of granodiorite, two stocks of quartz diorite, and two stocks of syenite. The granodiorite stock in central Dokis Township is approximately 2,500 feet in diameter and has a microdioritic border phase. The two quartz diorite stocks are coarse-grained, light-coloured rocks occurring in the southwestern part of Dokis Township and in the northern part of Tannahill Township. A syenite stock occurs in the southwestern part of Tannahill Township. This stock is associated with numerous dikes of syenite porphyry which cut strongly amphibolitized mafic volcanic rock. A small elongated, less than 500 feet, stock of syenite also occurs 2,000 feet north of Ghost Lake in Elliott Township.

Structural Geology: The general style of folding is concentric with the folding becoming more isoclinal to the north. An anticline extends from the south boundary of Elliott Township eastward through the southern parts of Tannahill and Dokis Townships. Small curvatures in the fold are thought to reflect the centres of volcanism to the south (see ODMNA, Preliminary Geological Series Maps P.629, P.692, and P.693). A complementary syncline north of the anticline strikes east-northeast through the area and shows a broadening of the volcanic belt eastward by its divergence away from the anticline.

Faulting in the area is limited to regional block faults represented by narrow shear zones. Northwest-striking faults predominate in the western part of the map-area and northeast-striking faults in the eastern part of the area. The intersection of the two sets of faults divide the area into rectangular blocks.

Economic Geology: Gold and chalcopyrite were the only two economic minerals noted in the map-area. Gold associated with pyrite-bearing syenite occurs 2,000 feet north of Ghost Lake. Grab samples reported by Sylvanite Gold Mines Limited, from surface exposures of the syenite contain amounts of gold as great as .22 ounces per ton. Assays as high as .03 ounces gold per ton were also reported by Sylvanite Gold Mines Limited in the cherty tuff for lengths of up to 15 feet in diamond drill hole logs.

Gold-bearing quartz veins and syenite porphyry dikes occur in the southwestern part of Tannahill Township. The quartz veins are associated with shear zones that strike from N45E to N70E and dip 60 degrees south. The quartz veins are from 1/8 to 2 inches wide and extend in and along the zone of shearing for 200 feet. Assays reported by Sylvanite Gold Mines Limited from quartz vein material range from trace to .05 ounces gold per ton. A syenite dike associated with the zone of shearing is 18 inches wide and is traceable for 1/2 mile. Assays of samples reported by Sylvanite Gold Mines Limited over a width of 1.5 feet across the dike give .33 ounces gold per ton. Grab samples from the dike assayed from trace to .85 ounces gold per ton (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake).

Small amounts of disseminated chalcopyrite, pyrite, and pyrrhotite are in an outcrop of quartz diorite in the northwestern part of Tannahill Township. The extent of mineralization is not known because of extensive overburden in the area. Small amounts of massive pyrite and pyrrhotite were also noted in Dokis Township in mafic volcanic rocks, west of the granodiorite stock.

Visible disseminated pyrite and pyrrhotite is found in most of the volcanic rocks. In some locations, concentrations of pyrite and pyrrhotite form gossans from 6 inches to 10 feet wide over lengths of 10 to 50 feet.

Areas in and around the granodiorite and diorite stocks appear to be favourable areas for sulphide mineralization, and the syenite dikes in the southwest part of Tannahill Township should be checked for gold.

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No. 18 GAUTHIER TOWNSHIP

DISTRICT OF TIMISKAMING

by

E.D. Frey[1]

Location: Gauthier Township is 8 miles east of Kirkland Lake. Highway 66 passes through the southern half of the township. In addition, excellent road access to within 2 miles of any point in Gauthier Township is provided by a gravel road to Esker Lake Provincial Park, 10 miles north of the township, by access roads to the mines of Upper Canada Mines Limited and Upper Beaver Mines Limited and by an irregular network of bush and logging roads.

Reconnaissance examination of the northern third of the township was followed by mapping at a scale of 1 inch to 1/4 mile. New aerial photography, logging roads, and detailed traversing revealed numerous areas of outcrop not previously mapped. Mapping proceeded on an intermittent basis during June and July 1971 and is expected to be extended to the rest of the township in 1972.

Mineral Exploration: Intensive gold prospecting has occurred throughout Gauthier Township since the earliest gold discoveries of the Kirkland Lake-Larder Lake area. Major discoveries have led to the production of gold and byproduct silver at Upper Canada and Upper Beaver Mines. The Upper Beaver Mine has also been a copper producer since 1965. Both mines were in production in 1971 under the control of Upper Canada Mines Limited and are scheduled to close their mining operations by the end of 1971.

Base metal exploration has eclipsed the search for gold in the last decade and is mainly confined to the felsic pyroclastic zone north of the Timiskaming-type sedimentary-volcanic series striking southeastward through central Gauthier Township.

In 1971, Upper Canada Mines Limited conducted a bedrock geochemical sampling program in the northern part of the township in addition to detailed underground and surface mapping at the Upper Beaver Mine site. Other recent activity includes ground EM and magnetometer surveys on the Brennan-Joy-Harris and International Mine Services Limited properties; diamond drilling and EM by T.C. Taylor; an airborne EM survey by Upper Canada Mines Limited (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake).

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[1] Geological assistant to Resident Geologist, Ontario Department of Mines and Northern Affairs, Kirkland Lake, Ontario.

General Geology: The main lithologies of the mapped area are east-trending intermediate to basic Archean lava flows overlain by felsic to intermediate tuff and agglomerate. Basic lava is limited to pillowed, porphyritic basalt along the northern boundary of the township. Several small syenite plugs intrude these units. Diabase dikes 60 to 100 feet wide of probable late Proterozoic age occur in the northwestern part of the area. A Pleistocene esker complex and sand dunes cover most of the western part of Gauthier Township.

Structural Geology: Non-reversal of north-facing pillow tops in dacitic to basaltic flows and the east- to southeast-striking subvertical attitude of the tuff and agglomerate units indicate a westward extension of the north limb of the Spectacle Lake Anticline (Thomson 1941, p.32).

Economic Geology: Thinly layered massive pyrite mineralization in felsic tuff was observed in a narrow shear zone exposed by Victoria Creek in the north-central part of the township.

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No. 19 BARTLETT AND GEIKIE TOWNSHIPS

DISTRICT OF TIMISKAMING

by

D.R. Pyke[1]

Location: Bartlett and Geikie Townships are about 20 miles south of Timmins. Bartlett Township is readily accessible by a gravel road from Timmins, which extends south as far as Sothman Township; a side road in English Township leads east to Matachewan. Lumber roads extend north from the Matachewan road to the south-central boundary of Geikie Township.

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[1] Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Mineral Exploration: Following the discovery of gold in the Porcupine area in 1909, prospectors soon worked their way south into Bartlett and Geikie Townships. Early exploration was confined mainly to the northern half of Bartlett Township, and although a number of surface showings were stripped, trenched, and in a few places explored by shallow shafts, no significant discoveries were made.

In 1951, Dominion Gulf Company discovered nickel-bearing sulphides on a group of claims along the northern half of the Bartlett-Geikie township boundary. The property was subsequently acquired by Fatima Mining Company Limited (now Texmont Mines Limited) which in 1959, sunk a three-compartment shaft and developed two levels. Following this the property was inactive until late 1964 when surface diamond drilling was resumed. In July 1971, the property was brought into production by Sheridan Geophysics Limited (Northern Miner 1971, p.985). Ore reserves are estimated at 3,800,000 tons grading 1.0 percent nickel after dilution; present production is about 500 tons per day with an anticipated rate of 1,000 tons per day by the year end (Northern Miner 1971, p.985).

Since the discovery of nickel mineralization by Dominion Gulf Company, numerous companies have conducted ground magnetic and electromagnetic surveys over most of the eastern half of Bartlett Township and the adjoining area in Geikie Township. Within this area, with the exception of the Texmont Mines Limited nickel property, nine companies (Assessment work files, ODMNA, Resident Geologist's office, Timmins) have sunk a total of 60 diamond drill holes for a combined length of 30,000 feet to test various geophysical and geological anomalies.

During the summer of 1971, Texas Gulf Sulphur Company completed a geological and geophysical survey on a group of 19 claims in north-central Bartlett Township, and on an adjoining claim block in southern McArthur Township. The claims are underlain mainly by felsic pyroclastic rocks and minor iron formation and intercalated clastic metasediments.

Falconbridge Nickel Mines Limited completed line cutting on a group of 17 claims northwest of Geikie Lake. The property, mostly drift-covered, appears to be underlain mainly by ultramafic and mafic metavolcanics.

General Geology: The area is underlain almost entirely by Early Precambrian rocks. Pleistocene and Recent deposits mantle much of the central part of Bartlett Township and the western half of Geikie Township.

The western half of the area affords a relatively continuous stratigraphic sequence for this part of the Timmins area. Pillowed mafic metavolcanics are the oldest rocks and are exposed for a maximum thickness of 5,500 feet in the western part of Bartlett Township.

A concordant, sill-shaped body composed mainly of gabbro occurs stratigraphically above the pillowed metavolcanics and retains a consistent thickness of about 6,000 to 7,000 feet across the township. A gross, poorly defined, large-scale layering appears to be present throughout much of the intrusive complex. This is particularly evident in the southern part of the intrusion where layers of gabbroic anorthosite and pyroxenite up to 300 feet wide can be traced 1/2 mile along strike. Small-scale layering with individual units ranging in width from 2 inches to 3 feet, occurs locally. The roof of the mafic intrusion is in contact with an intermediate (dacitic) metavolcanic sequence with a maximum thickness of about 4,000 feet. Tuff and lapilli-tuff predominate, although minor intermediate and mafic metavolcanic flows are present.

A sequence composed mostly of felsic metavolcanics up to about 10,000 feet thick underlies much of the eastern half of Bartlett Township. Minor clastic as well as chemically precipitated metasediments (chert and iron formation) form discontinuous layers within the middle and upper portions of the sequence. An extensive area of drift obscures the lower contact with the dacitic metavolcanics.

Serpentinized dunitic and peridotitic rocks overlie the felsic metavolcanics and form the southward extension of the metamorphosed ultramafic rocks in McArthur Township (Pyke 1971) to the north. These ultramafic rocks are characterized by numerous occurrences of the texture colloquially termed "chicken track", "bird track", or "laths" in the Timmins area. Many of these rocks, originally mapped as metavolcanics (Bruce 1926; Berry 1940), were subsequently included with the ultramafic intrusions (Ginn et al. 1964; Pyke 1970), although it is recognized that other possible modes of origin existed (Naldrett and Mason 1968; Prest 1950; Pyke 1970). Recent observations (Pyke et al. in preparation) in the Timmins-Kirkland Lake area confirm the extrusive volcanic origin of many of these ultramafic rocks. In some areas of good exposure, individual flows can be readily discerned. The upper surfaces of the flows are characterized by a distinctive flow top breccia; beneath the breccia there is commonly a "chicken track" or "lath" unit which may be a few inches to several feet in thickness; the underlying lower parts of the flows are commonly massive. Both the flow top breccia, and variation in the size of quenched[1] olivine grains within the "chicken track" or "lath" units give readily recognizable and reliable primary top determinations[2]. A more detailed description of the "chicken track" or "lath" structure is given by Pyke (1970), as well as a description of polygonal jointing which is characteristic of many of the outcrops. The ultramafic metavolcanics have a maximum thickness of about 5,000 feet.

A thin veneer of predominantly mafic metavolcanics overlies most of the ultramafic metavolcanics and is in contact with a large porphyritic granodiorite stock which underlies most of Geikie Township.

Epizonal, quartz-feldspar porphyry intrusions form small stocks in the felsic and ultramafic metavolcanics in the north-central part of the area. These intrusions may be subvolcanic in origin.

The eastern margin of a large granitic batholith (Ginn et al. 1964) extends into the northeastern part of Bartlett Township.

Diabase dikes are the youngest rocks in the area and generally strike in a north, northwest, or northeast direction.

Regional metamorphism of the Early Precambrian volcanic and sedimentary rocks took place under greenschist facies conditions

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[1] It is generally accepted that the elongate lath- or blade-like crystals of olivine are the result of quenching (e.g. see Viljoen and Viljoen 1969).

[2] When a "lath" or "chicken track" layer is present within an ultramafic flow unit, there is a variation in the size of individual "laths", from coarse at the bottom to fine at the top of layer.

Structural Geology: The main structural trend in the area is north-south, with a gentle convexity to the east. No major folds were detected. Numerous top determinations from pillows, graded bedding, flow top breccias and size variation of "lathes" in the ultramafic flows all indicate that the sequence faces eastward.

A northwest-striking fault extends along Marceau and Scott Lakes, and seems to have a left-lateral displacement up to 1.5 miles. Quartz stockworks, epidotization, and shearing attest to the presence of a fault zone coincident with the long axis of Muskasenda Lake.

Economic Geology:

Nickel: With the exception of trace amounts of nickel associated with the iron formation, all known nickel occurrences are in the ultramafic rocks. The ore minerals at the Texmont Mine consist of pyrite, pyrrhotite, pentlandite, and millerite, and occur typically as fine disseminations or as blebs or patches up to 1/4 to 1/2 inch in maximum dimension. Serpentinites at the Texmont mine site, as well as those forming the host rock for the ore zones, are typically massive and lack the characteristic structures diagnostic of the ultramafic flows discussed in the section on "General Geology". Moreover, with the exception of one exposure, all the observed outcrops of massive serpentinite form a narrow unit along the west or lower contact of the ultramafic rocks extending north and northeast from the Texmont mine area to McArthur Township. Exposures along this lower contact are sparse, and no outcrops of typical ultramafic flow rocks were closer than a few hundred feet to the massive serpentinite. However diamond drilling by Texmont Mines Limited has disclosed that quenched ultramafic rocks (as recognized by the development of "lath" type or "chicken track" structures) are above and within 100 feet of the ore zones. This close spatial relationship between the massive serpentinite and the stratigraphically lowest appearance of quenched ultramafic rock in the vicinity of the ore zone may be fortuitous, but at the same time is indicative of a possible genetic relationship (Eckstrand, in press). Criteria for distinguishing whether or not the massive serpentinite is of intrusive or extrusive origin were not observed, but the close spatial relationship of the two types of serpentinite points to a common mode of formation. Analytical results (Assessment work files, ODMNA, Resident Geolotist's office, Timmins) from available diamond drill holes indicate a notable difference in background nickel values between the massive type and the non-massive, flow origin, type of ultramafic rock. The former type averages about 0.25 percent nickel; the latter about 0.15 percent nickel.

Copper: Trace to minor amounts of copper are associated with the sulphide (pyrrhotite-pyrite) facies of the iron formation. The best recorded analysis (Assessment work files, ODMNA, Resident Geologist's office, Timmins) is 5.20 percent copper across 3.5 feet from the former Peterson-Bannerman-Brison Property now held by R. Allerston, about 1 mile north of Boomerang Lake. However most of the copper mineralization in the iron formation appears to be spotty and discontinuous.

Asbestos: Minor asbestos seams occur locally throughout the ultramafic rocks. The nickel property of Texmont Mines Limited was originally acquired by the Dominion Gulf Company for its asbestos potential. One outcrop area near the southwestern corner of Falconbridge Nickel Mines Limited claims west of Geikie Lake contains an abnormal concentration of asbestos veinlets; in one place 12 seams, each about 1/16 inch wide, were counted over a width of 1 foot.

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No. 20 MACMURCHY AND TYRRELL TOWNSHIPS

DISTRICTS OF SUDBURY AND TIMISKAMING

by

M.W. Carter[1]

Location: The two townships straddle the Districts of Sudbury and Timiskaming, Tyrrell Township lying in the Timiskaming District, Macmurchy Township lying in Sudbury District. They are between longitudes 80°55' and 81°12'W, and between latitudes 47°31' and 47°40'N. Access is good. Highway 560 passes through both townships and connects Gowganda and Elk Lakes on the east with Westree to the west. The area is connected with Sudbury by Highways 560 and 144. These roads are all-weather gravel roads. Macmurchy Township forms part of the West Shining Tree gold area, which comprises Churchill, Macmurchy, Asquith, and Fawcett Townships.

Both townships were mapped at a scale of 1 inch to 1/4 mile during the summer of 1971.

Mineral Exploration: Exploration in the two townships was carried out mainly for gold and silver from the first decade of this century. Latterly, attention was directed to the search for copper and nickel-copper deposits. The discovery of silver at Gowganda Lake in 1908 and gold in Macmurchy Township in 1910 led to almost continuous exploration activity thereafter. Gold and copper were sought in the Archean rocks, silver in the Proterozoic rocks, and nickel-copper mineralization in the serpentinite bodies emplaced in the Archean. Exploration consisted of pitting, trenching, diamond drilling, and geophysical work, carried out by numerous prospectors and mining companies. As a result of this work six shafts were sunk and one producing gold mine was established.

In 1935, Shinintree Gold Mines Limited extended a shaft to 85 feet depth on its property at Wasapika Lake in Macmurchy Township. The shaft was sunk on a fault or shear zone 3 to 8 feet wide and 400 feet long striking northwest. On the Bilmac Gold Mines Limited property in the same area, three shafts were put down by 1938. Two of these were on their Saville quartz vein; one of the shafts extending to a depth of 40 feet, the other to a depth of 420 feet. Development work was carried out on three levels: the 65-foot, the 175-foot and the 400-foot levels. The third shaft, on the Evelyn Vein, which is east of and parallel to the Saville Vein, was sunk to a depth of 87 feet. This development work did not lead to production, however, from either vein.

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In Tyrrell Township, exploration activity culminated in the development of a producing gold mine operated by Tyranite Mines Limited. This property, located on the north-central boundary of Tyrrell with Knight Township, was developed by a three-compartment shaft sunk to 550 feet. Production was from three levels, the 225-, 375-, and 525-foot levels, during the period 1939-1942. At the Matona Gold Mines Limited property near Hydro Creek, a two-compartment shaft was sunk to a depth of 231 feet, and two levels were established at 125 feet, and 215 feet respectively. This prospect did not develop into a mine.

General Geology: Geological investigations began in the area in the latter part of the last century and continued up to 1931 when A.R. Graham (1932) prepared a map at a scale of 1 inch to 3/4 mile which included Tyrrell Township and the eastern part of Macmurchy Township.

Bedrock in the area belongs to the Archean and Proterozoic divisions of the Precambrian.

The Archean rocks comprise metavolcanics, metasediments, and intrusive rock bodies. Two principal sequences occur. One sequence, formerly referred to as Keewatin, consists of an interbedded sequence of basalt, andesite, and dacite-rhyolite. Andesitic rocks predominate. Minor interflow arenaceous and argillaceous metasediments occur. The general occurrence of amygdaloidal and pillow structures and interbedded metasediments shows that the volcanic rocks were formed as submarine flows. Associated with this sequence are massive, altered medium-grained mafic rocks which may be intrusive. Pyroclastic rocks are subordinate. The volcanic and sedimentary rocks have been mildly metamorphosed, but in localized areas marked dynamic metamorphism has occurred, converting the rocks to amphibole schists and quartz-carbonate-sericite schists. These schistose zones contain quartz and carbonate veins and veinlets. An isolated area north of Ashburn Lake in Macmurchy Township is underlain by a distinctive porphyritic hornblende-olivine-augite lamprophyre associated with olivine-pyroxene basalt agglomerate.

The second sequence, formerly referred to as Timiskaming, consists of intercalated metavolcanics and metasediments. The metavolcanics are dominantly felsic, consisting of trachyte and dacite-rhyolite, and their pyroclastic equivalents. Megascopic flow structures were not observed, but amygdaloidal structure is present. The metasediments intercalated with these metavolcanics consist of arenaceous and argillaceous rock types showing graded bedding and current bedding. Conglomerate, arkose, and argillite are present.

Irregular intrusive masses of hornblende lamprophyre, granophyre, and porphyry, innumerable diabase dikes, and the fringe of a granodiorite pluton cut the metavolcanics and metasediments. Also intrusive are small lenses of serpentinized dunite. Small masses of sulphide-facies iron formation occur in both metavolcanic-metasedimentary sequences.

The Proterozoic sequence consists of unconformably overlying sedimentary rocks intruded by diabase sills. The sedimentary rocks are best exposed in eastern Tyrrell Township where they consist of conglomerate, arkose, greywacke, argillite, and siltstone. Outliers of these rocks occur in Macmurchy Township. The intrusive diabase is quartz diabase, occurring as horizontal and inclined sills. The diabase is differentiated in places to fine- and very coarse-grained granophyric segregations containing pyroxene.

Structural Geology: The Keewatin sequence is steeply dipping and tightly folded around east-trending axes in western and central Macmurchy Township, and around north-northwest axes in eastern Macmurchy and Tyrrell Townships. The strata dip either to the north or south, or to the northeast or southwest at angles ranging from 75 to 85 degrees. In the Timiskaming sequence in northern Macmurchy Township, the strata consistently face north but are overturned to the south, dipping 75 to 85 degrees south. In Tyrrell Township, however, the Timiskaming rocks dip either to the northeast or southwest, at angles ranging from 75 to 85 degrees. The folds are open. It is believed that there were two periods of deformation, the second resulting in folding of the Timiskaming sequence rocks and refolding the Keewatin sequence rocks. Shearing is widespread in the area, confined mostly to the metavolcanics and metasediments. No preferred trend was apparent.

The Proterozoic sequence has dips of from 10 to 55 degrees east, the high dips being confined to the region occupied by Duncan Lake, where microfolding and the formation of slates indicate faulting. Slump structures are common in the sedimentary rocks. In areas underlain by Proterozoic sedimentary rocks, the intrusive diabase bodies are concordant with the bedding, proving them to be sills. Where these diabase bodies occur alone on the Archean basement, they appear as horizontal sheets.

Economic Geology:

Pyrite: Pyritization is ubiquitous in the area, and occurs mainly in both the Keewatin and Timiskaming rocks. It is concentrated in narrow shear zones, especially in the felsic rock units. Concentrations reach up to 5 percent. It is also concentrated in the banded iron formation, where in places it is present in amounts as high as 10 percent.

Gold: Gold occurs in two ways: either in shear zones "infiltrated" with narrow quartz veinlets, or as quartz veins up to 1 foot wide. The shear zones do not seem to have any preferred orientation, but commonly follow the strike of the fold axial traces. It is clear from the mapping that mineralization in the metavolcanics is markedly associated with narrow shear zones, especially in rhyolitic units, and attention should be directed towards such shear zones.

The most important occurrence was the Tyranite Mines Limited deposit in Tyrrell Township. This occurrence consisted of two, parallel, north-trending, carbonatized, and pyritized shear zones, which constituted the orebodies. On the surface, one body was 400 feet long by 39 feet wide; the other 200 feet long by 20 feet wide. The gold occurred in the heavily mineralized zones which formed pods and lenses. Average grade was $7.00 (1939 price, Northern Miner 1939, p.243). Production was maintained from this property as an underground mine from 1939 to 1942, when 223,810 tons of ore, valued at $1,165,833 were processed by a 250-ton mill (Canadian Mines Handbook 1944, p.267).

The Matona Gold Mines Limited deposit near Hydro Creek, Tyrrell Township consists of a shear zone striking N70W to N40W and dipping vertically or at 65 degrees southwest. On the surface it is about 150 feet long and between 8 inches and 12 inches wide. This shear zone, which constitutes the "Main Vein", is mineralized with carbonate, quartz, fine-grained pyrite, and gold. Systematic sampling and development work disclosed 30,000 tons of material of $10.00 grade (1945 price) (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake). This property was never brought to production.

The Bilmac Gold Mines Limited property at Wasapika Lake, Macmurchy Township, consists of two parallel quartz veins: The Saville Vein and the Evelyn Vein (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake). The veins strike N60W and dip 65 degrees south. The Saville Vein is 1,000 feet long at the surface and varies in width from 4 inches to 3 feet. It is a shear zone containing individual lenses of milky white quartz ranging from 15 feet to 80 feet in length. Mineralization consists of native gold associated with the quartz. The Evelyn Vein consists of banded slate and pyrite and is 300 feet to the north and east of the Saville Vein. It is 1,200 feet long on the surface and of undetermined width. The indicated ore from the property was estimated at 250,000 tons averaging $12.00 gold per ton (1938 price) (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake).

Silver: This metal was sought by prospectors in the diabase sills intruding the Proterozoic sedimentary rocks. Mapping by the author shows that there may be a spatial relationship between silver occurrence and pegmatitic, granophyric differentiates of the diabase. It is recommended that such coarse-grained granophyre be emphasized in prospecting.

The most important occurrence was at Mosher Lake (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake) on the property of Benvan Mines Limited in Tyrrell Township. The silver occurs in sets of silver-cobalt-calcite veins in two zones in a 900-foot thick diabase sill dipping 25 degrees east. The two zones are: the Sinclair (Upper Contact) Zone, and the Mosher Bay Zone in the centre of the sill. A third zone, the Lower Contact Zone, was considered a potential target area. In the Sinclair Zone, the veins trend east-west for an exposed length of up to 90 feet, and one is 3 feet wide. The veins are calcite-filled fissures carrying native silver, cobalt as arsenides, and chalcopyrite and pyrite. A grab sample from one vein yielded 587.73 ounces silver per ton (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake). In the central, Mosher Bay Zone, the system consists of several calcite veins radiating from north through to east. They vary in width from 1 to 6 inches and are entirely enclosed by the diabase. A grab sample returned 175 ounces silver per ton (Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake). The trend of the main vein in this zone is east-northeast and extends along strike for 100 feet. The Lower Contact Zone, which contains only pyrite, consists of quartz-filled fractures.

Copper: This metal was not sought in the past. It occurs as chalcopyrite in quartz veins occurring predominantly in rhyolitic rocks, whether sheared or not. Chalcopyrite also occurs in calcite veins up to 1 foot wide in massive, dark trachytic-keratophyric rocks in the Keewatin sequence. There is a little chalcopyrite along joint surfaces in diabase dikes.

One occurrence of copper is on C.W. Burnet's property near the intersection of Highway 560 and the West Montreal River. The mineralized zone, consisting of quartz, calcite and brecciated rhyolite, is 4 feet wide with an exposed length of 100 feet. The ore minerals are pyrite, chalcopyrite, malachite, azurite, and minor specular hematite. The strike of the mineralized zone is S85W with a dip of 75 degrees south. A grab sample from this zone taken by the writer was found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 2.02 percent Cu, trace gold, and trace sulver.

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No. 21 FRECHETTE, McNAMARA, AND COTTON TOWNSHIPS

DISTRICT OF SUDBURY

by

H.D. Meyn[1]

Location: The three townships form an east-west strip approximately 18 by 6 miles. The centre of Cotton Township lies approximately 42 miles due north of Sudbury. Access is provided to the east side of Cotton Township by the service road to the new 500 kv transmission line of the Hydro-Electric Power Commission of Ontario. A very rough road leads from the service road to the southeastern part of Burwash Lake. The central part of Frechette Township can be reached by the Canadian National Railways line and the service road to the old transmission line of the Hydro-Electric Power Commission of Ontario. A rough road leads from central Frechette Township (McKee's Camp) to Burwash Lake. This road provides access to the northern part of McNamara Township, but only the first 9 miles are serviceable. The last 4 miles are unusable because a number of bridges are out. The remainder of the area, especially the southern half of McNamara Township, can be reached from numerous lakes suitable for float-equipped aircraft.

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The area was first mapped by W.H. Collins (1917) as part of a regional reconnaissance survey. The three townships immediately to the south were mapped by this author in 1970 (Meyn 1971). The east half of Cotton Township was also included in Operation Maple Mountain in 1968 (Card et al. 1970).

Mineral Exploration: Parts of Frechette Township have been staked in the past for sulphide showings. Some staking was carried out in 1971 in the centre of the township on and adjacent to a sulphide showing occurring in a breccia and shear zone. No information is available on mineral exploration in McNamara Township. Activity also has been limited in Cotton Township, but here 52 surveyed claims covering Archean iron formation are held by Ironco Mining & Smelting Company Limited. Ten claims adjoining this group to the south were staked in August, 1970.

The contact of the Huronian metasediments with the basement has been explored for uranium occurrences. A small, isolated occurrence of radioactivity is reported from one locality in the Lorrain Formation in north-central Frechette Township. It is attributed to thorium associated with hematite in the metasediments.

General Geology: The area is underlain by Precambrian rocks of various ages with a discontinuous cover of Pleistocene to Recent deposits of bouldery sand, gravel, sand, clay, and organic matter.

The oldest rocks of the area are metavolcanic flows, hypabyssal intrusions, and iron formation. Only remnants of these rocks are still found because these rocks were intruded by granitic magma and to a large extent assimilated. The iron formation, although metamorphosed, was the most resistant to magmatic assimilation. The granitic rocks vary in colour from pink to dark grey and in composition from granite and quartz monzonite to quartz diorite and diorite. These rocks were intruded by mafic dikes of diabase, gabbro, and amphibolite.

The above assemblage forms the basement on which the Huronian sedimentary rocks were deposited. Rocks of the Gowganda and Lorrain Formations are present in all three townships. The lower and higher Huronian formations are absent. The Gowganda Formation is typically composed of finely bedded and laminated argillite and interbedded argillite interbedded with arkose or quartzite, with minor pebbly mudstone and minor conglomerate. A boulder conglomerate is generally present at the base of the Gowganda Formation. In this area, the conglomerate may be the only member of the Gowganda Formation that is present. Generally the conglomerate is slightly stratified or interbedded with stratified rocks indicating a water-laid origin for the whole formation in this region.

The Lorrain Formation typically consists of well-bedded to massive greyish-green and pink feldspathic quartzite; and quartzite with many single dispersed pebbles and random pebble-beds up to 2 feet thick but generally with only one pebble layer up to 2 inches thick. The pebbles are mostly white vein quartz with minor amounts of black chert, red jasper, and other lithologies.

The Huronian and Archean rocks were intruded by sills and sill-like, slightly crosscutting sheets of Nipissing Diabase. A very large sheet of about 5 square miles occupies the boundary between Frechette and McNamara Townships.

The Vermilion River was once a major glacial drainage channel, and extensive and thick deposits of sand and gravel are found in the flood plain of the glacial valley which was much wider than the present valley and is now occupied by Thor and Edna Lakes.

Most of the Pleistocene material is a bouldery and sandy gravel of a ground moraine, in many places about 100 feet thick.

Structural Geology: The metavolcanics generally possess a well-developed, steep to vertical foliation but this is often obliterated by the effects of intrusion of the granitic rocks. The original foliation is well preserved in the iron formation. Some of the pre-granitic rocks are intrusive and show no foliation.

The granitic rocks exhibit little structure. Dikes are not abundant in the granite and aplitic ones predominate over pegmatitic ones. Jointing is the only common structural feature of the granite.

The contact between the Huronian metasediments and the basement is seldom found undisturbed. Generally the contact is in a near-vertical position, indicating rotation of both the cover and the underlying rocks. Shearing is evident in many places along the contact. The dip of the sedimentary rocks varies from 5 degrees, probably original, to vertical. The area was tectonically active and block faulting is the predominant structure. Minor structures, except for jointing and shearing near dislocations, are absent.

Economic Geology: A large body of iron formation is present in the southeast quarter of Cotton Township. Magnetite-quartz-amphibole iron formation with a sinuous strike-length of 7.2 miles is up to 500 feet wide. Fifteen possible open-pit mining areas have been outlined. The pit areas contain indicated or inferred reserves of 450,000 tons per vertical foot averaging 20.7 percent iron. Potential tonnage is estimated to be more than 100 million tons. Preliminary concentration tests indicate a concentrate grading 68.2 percent iron and 5 percent silica can be made with a recovery of 93 percent (Shklanka 1968, p.329). Most of this is currently held by Ironco Mining & Smelting Company Limited. About 1 mile north of the main iron formation another small lens of iron formation is present (Shklanka 1968, p.330). The iron formation reported by Shklanka (1968, p.331) in McNamara Township was not seen.

In the granitic rocks, no metallic mineralization was noted. In the metasediments, the only radioactivity present, in the Lorrain Formation, is confined to one locality and here it is attributed to thorium associated with heavy mineral placers of hematite at the base of sedimentary beds. Sedimentary magnetite of a few percent, sufficient to cause magnetic anomalies for airborne surveys (GSC 1965), is present in the Gowganda Formation.

Pyrite is also present in this formation and this may locally be concentrated by recrystallization into cubes up to 1/4 inch in diameter. In McNamara Township on the east shore of the small lake south of Wrench Lake, a small sulphide vein was discovered in 1970 (Meyn 1970) and reexamined in 1971. The vein is about 8 feet long and a maximum of 6 inches wide. It pinches out at both ends. A smaller one, parallel to it, is a few feet away. The contact both with the basement and with a large sheet of Nipissing Diabase is nearby and could be connected with the origin of this vein.

A fairly large and well-mineralized sulphide showing is present in a breccia and shear zone which cuts through Gowganda and basement rocks in west-central Frechette Township. Chalcopyrite, pyrite, and minor pyrrhotite are present along a silicified zone 1 to 4 feet wide and extending sporadically over a length of 2,000 feet with a strike N25E and a dip from vertical to easterly. Channel samples across the zone were found on analysis to contain 10.3 percent copper over 3 feet, and one diamond drill hole intersected dominantly low-grade copper values over 250 feet but includes values up to 1.81 percent copper over 4 feet in felsite and syenite. Disseminated sulphides are present in adjacent sedimentary rocks also and a chip sample containing 4.94 percent copper was taken from a mineralized section (Shklanka 1969, p.244).

The major mass of Nipissing Diabase has locally highly disseminated sulphide specks in it. One occurrence with a slight concentration of sulphide is present in highly sheared Nipissing Diabase in the railroad cut southeast of Lue Lake.

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No. 22 WAKOMATA LAKE AREA (WEST HALF)

DISTRICT OF ALGOMA

by

F.W. Chandler[1] and S. Masson[2]

Location: The area is centred on Wakomata Lake which is approximately 30 miles north of Thessalon on the Chapleau Highway, Highway 129, and is equidistant between Sudbury and Sault Ste. Marie. The area consists of Otter, 188, and 182 Townships as well as Galbraith Township east of Petauguin Lake and Haughton, Gould, and Grasset Townships north of latitude 46°30'N. During the summer of 1971, the area west of Wakomata Lake was mapped at a scale of 1 inch to 1/4 mile.

Fly camps were placed by means of float-equipped aircraft on Darragh and Burden Lakes to give access to northwest and east Otter Township. The rest of the area was reached by road and canoe. Highway 129 and gravel roads permit access to Chub, Cooper, Jobammageeshig, Pine Island, Saunders and Wakomata Lakes, and the Mississagi River south of Snowshoe Creek, on which powered boats were used.

Mineral Exploration: The area has been prospected for copper since the beginning of the century. Exploration has been concentrated on quartz veins, probably associated with diabase intrusive bodies.

A 3,300-foot long quartz vein system in a Nipissing Diabase sill strikes S65E from the east end of Burden Lake in east Otter Township. This vein system has received attention since 1910 (Burrows 1910, p.196). Mineralization includes chalcopyrite, chalcocite, cobaltite, and bismuth. An analysis of a bismuth-bearing sample indicated 59.5 percent bismuth, 0.03 ounces gold per ton, and 15.9 ounces silver per ton (Burrows 1910, p.196). A bulk sample of 3.7 tons yielded 14.7 percent cobalt, 9.2 percent nickel, 9 ounces silver per ton (Sergiades 1968, p.20). In 1929 the Cheney Mine, situated on an east-striking, chalcopyrite-bearing quartz-carbonate vein in north-central Gould Township, produced 34,000 pounds of copper valued at $8,564. Reserves in the presently inactive mine include about 40,000 tons of ore having a grade of 4 percent copper (Shklanka 1969, p.26).

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More recent exploration for copper was by diamond drilling. In 1956, Fano Mining and Exploration Incorporated drilled six holes totalling 1,003 feet to test a chalcopyrite-bearing shear zone in Archean granitic rocks in southwestern Otter Township. The best recorded analyses were 1.71 percent copper over a width of 2 feet and 3.51 percent copper over a width of 5 feet (Shklanka 1969, p.26). In 1966 to 1967, G. Poirier drilled 80 feet on the chalcopyrite-bearing quartz vein on the Huston Lake Prospect or Gould Mine (Shklanka 1969, p.26) in northwest Gould Township (Shklanka 1969, p.28). A drift is being driven at present along the vein by Gould Copper Mines Limited. In the summer of 1971, four holes totalling about 1,220 feet were drilled on the Reuben McKee Property in east Otter Township into a chalcopyrite-bearing quartz vein associated with a diabase intrusive in Archean granitic rocks (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie).

In 1956, Pluton Uranium Mines Limited drilled three holes, totalling 546 feet, into a chalcopyrite-bearing quartz vein in sandstone of the Gowganda Formation. The site is 1/4 mile west of the outlet of Wakomata Lake in Township 188 (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie).

Ground geophysical surveys were carried out as follows: in 1966, on the north shore of Jobammageeshig Lake by the Mississagi Mining Company Limited and on the west shore of Wakomata Lake by Jubilant Creek Mines Limited, and in 1968, on the Reuben McKee property by Rio Tinto Canadian Exploration Limited (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie). Since 1968, minor staking and development work has been carried out on copper prospects in the area by R.J. Jowsey Mining Company Limited (now Open End Mines Limited) and others.

As a result of discovery of the Blind River uranium deposits, exploration for this metal has been carried out to test the Huronian rocks in the southwestern part of the area. To date, however, no deposits have been found.

In 1966, Kerr Addison Mines Limited drilled 529 feet in four holes to test quartz pebble conglomerate in the Matinenda Formation near the centre of the south boundary of Otter Township (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie). In 1968, Imperial Oil Enterprises Limited drilled two deep holes. The first, at the southwest end of Skookum Lake in Galbraith Township, passed through Huronian sedimentary rocks to reach Archean granitic rocks at 2,443 feet. The second, on the north shore of Cooper Lake in Haughton Township, passed through 1,100 feet of basalt and 1,450 feet of Huronian sedimentary rocks before reaching Archean granitic rocks (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste.Marie).

Aerial geophysical surveys to search for radioactive anomalies were flown in 1968 by Subeo Limited and by W.D. Sutherland and associates (Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie).

General Geology: Parts of the area have been mapped by Collins (1925), Emmons (1926, Map 194A), and Frarey (1959). Granitic Archean rocks underlie the northern half of the area as well as a salient, the Haughton High, in the northeastern part of Haughton Township. The granitic rocks are dominantly pink, massive, and granular. Small pockets of porphyritic and gneissic varieties and volcanic rocks occur.

A belt of "greenstone", some of which is amygdaloidal, 1/8 of a mile wide, was traced 1/2 mile west from the west end of Cooper Lake in northwestern Haughton Township. The "greenstone" is similar in appearance to that found at the base of the Huronian to the west (Chandler 1970a; 1970b). This belt of greenstone was shown on previous maps as part of the Gowganda Formation (Giblin and Leahy 1967; Frarey 1969).

Huronian sedimentary rocks outcrop in the southwestern and eastern parts of the area. In the southwest, they underlie southwestern Otter, northeastern Galbraith, and northwestern Haughton Townships and lie nonconformably on Archean granitic rocks. Granitic orthoconglomerate is succeeded by laminated, grey, fine- to medium-grained sandstone which grade up into pale arkose. The above sedimentary rocks belong to the Matinenda Formation. At several localities in south-central Otter Township, rusty weathering quartz pebble orthoconglomerate beds are found in the above sequence. These rocks are succeeded by a massive paraconglomerate with a grey sandy matrix which it may be possible to correlate with the Ramsay Lake Formation. Medium- to coarse-grained, pale-coloured, feldspathic sandstone succeeds the paraconglomerate. Near the top of the sandstone, black chert and white quartz pebbles are scattered parallel to the bedding, particularly in northeastern Galbraith Township. In northeastern Galbraith and northwestern Haughton Townships, at least three mappable units of paraconglomerate resembling that correlated with the Ramsay Lake Formation occur in the feldspathic sandstone. It is not known yet whether these are separate stratigraphic units or whether the Ramsay Lake Formation has been repeated by faulting. The sandstone may belong to the Mississagi Formation.

The sandstone is succeeded by paraconglomerate of the Gowganda Formation which caps the hills around Cooper and Skookum Lakes. There is a tendency for orthoconglomerate to have been developed at the base of this formation. To the southwest in Galbraith Township, the conglomerate is succeeded by interbedded argillite and micaceous sandstone of the Gowganda Formation.

East of the Mississagi River, in northwestern Gould Township and southwestern Township 188, rocks of the Gowganda Formation have overlapped older Huronian formations and lie upon Archean granitic rocks. A massive paraconglomerate member with pink arkosic beds near the base is succeeded by a member of laminated argillite. By means of increasingly thick and coarse-grained intercalations of sandstone, the argillite grades upwards into a fine- to medium-grained, pink, feldspathic sandstone unit. Just beneath the sandstone unit there is a continuous mappable zone in which instability caused sand beds to slump into underlying argillite beds. The feldspathic sandstone is succeeded to the east, on the north and east shore of Wakomata Lake, by the arenaceous Lorrain Formation.

Archean rocks are transected by dominantly northwest-striking mafic dikes, including one of porphyritic appearance similar to the Matachewan dikes. Similarly trending dikes of quartz diabase, and at least one of olivine diabase, cut Huronian and Archean rocks. A quartz diabase sill with granophyric parts has been traced from the western boundary of Otter Township to the northwestern side of Wakomata Lake.

There are thin discontinuous deposits of sandy and gravelly till over much of the area. Glacial striations indicate that Pleistocene ice flowed from between north and northeast. The valley of the Mississagi River, including an area of 2 square miles on the west shore of Wakomata Lake, is underlain by thick terraces of fluvial gravel and sand.

Structural Geology: Weakly developed foliation in Archean rocks strikes northwest. Huronian rocks in the southwestern part of the area dip 10 to 30 degrees south to southwest. Upthrow of the base of the Gowganda Formation on the south shore of Skookum and Cooper Lakes indicates a possible fault striking along the line of these lakes. This fault may continue to the Cheney Mine and other copper showings along its strike south of Chub Lake in Gould Township and east of Little Pickerel Lake in Grasset Township (Giblin and Leahy 1967). A fault with a similar strike may occur 3/4 mile to the south.

The Huronian rocks east of the Mississagi River have been folded into an east-plunging syncline, of which the axial plane trace probably strikes along the south shore of Wakomata Lake. Dips are about 5 to 20 degrees. It is possible that this structure is the westward continuation of the Quirke Lake Syncline. If this proves to be correct the Quirke Lake structure would be an elongate basin. The present northward limit of the Quirke Lake Group, which is hidden under the Gowganda Formation in the region north of Thessalon, might prove to be an "S" beginning in western Township 176, south to Parkinson Township over a southeast-plunging anticlinal continuation of the Chiblow anticline, thence west to northern Rose Township and mirroring the Elliot Lake "Z" structure. No regional or thermal metamorphism was noted in the area.

Economic Geology: Mineralization in the area is of two kinds: copper in quartz veins in various rock types and pyritic quartz pebble orthoconglomerate in the Matinenda Formation.

Copper occurs primarily as chalcopyrite or chalcocite in east- to southeast-trending, steeply dipping quartz veins in fractures and shear zones. Gangue minerals include carbonate, specularite, and pyrite. The veins occur both in the Archean granitic rocks, in Huronian sedimentary rocks, and in diabase. Where veins do not occur in diabase, a close spatial association with that lithology was sometimes discovered. The veins are rarely above several inches wide. Exceptions include those in the Huston Lake prospect and on the Reuben McKee Property. On the latter property, loose blocks, about 6 inches in diameter, of vein quartz with 50 to 75 percent chalcopyrite, were found.

A quartz diabase sill of Nipissing-type and of variable width up to 1 mile, strikes east across the centre of the area. This body seems to be a likely site for vein-type copper mineralization.

Pyritic quartz pebble orthoconglomerate and quartz pebbly arkose, similar to the uranium ore-bearing facies of the Matinenda Formation of Elliot Lake, occurs in the central part of the south boundary of Otter Township. Drilling of this conglomerate by Kerr Addison Mines Limited, and examination of outcrop by the writer, failed to discover uranium mineralization.

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No. 23 MAY AND HALAM TOWNSHIPS

DISTRICT OF SUDBURY

by

James A. Robertson[1] and Krystyna Siemiatkowska[2]

Location: The map-area straddles the Spanish River between the towns of Espanola and Massey and is in the Massey copper belt. The only communities in the map-area are Webbwood and Lee Valley. The Trans-Canada Highway (Highway 17) and the Canadian Pacific Railway (Sault Branch) pass through the area. Much of the area is accessible by gravel road.

Mineral Exploration: A regional assessment of occurrences adjacent to the Murray Fault was carried out by Prosco Limited and has been filed with the Ontario Department of Mines and Northern Affairs. Some data is on file in the Resident Geologist's office, Sudbury, or in the Toronto office but many mineral rights are held by farm owners and much data on exploration have not been filed. The McKee, Grant, and Scott prospects in May Township were developed by shafts and some lateral work whereas others were developed by limited surface work and drilling. The Hallam prospect, lot 7, conc. III, Hallam Township, was tested by pitting and drilling. A zone at least 100 feet long and 3 feet wide, to a known depth of 120 feet, contains an estimated average grade of over 3 percent copper (Shklanka 1969, p.247). Much of the favorable area in northwestern May Township has been explored by A. Alexander; he is currently examining prospects near Whitson Lake and in lots 3 and 4, conc. VI, May Township. During the field season geophysical surveys were being carried out by Multi-Minerals Limited in the vicinity of the Hallam prospect.

Since 1953 the northwestern part of May Township and the vicinity of the Hallam-Shakespeare township boundary have been explored for uranium mineralization. Slightly radioactive pyritiferous quartz-pebble conglomerate is found as beds and lenses in the Matinenda Formation and the sedimentary rocks of Matinenda-type are interbedded in the Salmay Lake Formation. These beds contain minor amounts of uranium and thorium and traces of rare earth minerals. Exploration of these occurrences has been carried out by A. Alexander, Min-Ore Mines Limited, and Prosco Limited in the Salmay Lake-Whitson Lake area of May Township and by Moncrieff Uranium Mines Limited and Aggressive Mining Limited along the Shakespeare-Hallam township boundary. The latter companies did no work on their properties in 1971.

General Geology: The rocks of the area are in four main classes: 1) the Archean basement rock; 2) the Huronian sedimentary and volcanic rocks and their metamorphic equivalents; 3) the post-Huronian mafic intrusions; and 4) the Pleistocene and Recent unconsolidated sediments. In the map-area the

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Huronian rocks normally strike east-west and dip steeply south; an exception to this is a complexly deformed belt forming the north-central part of the area.

The oldest exposed rocks are Keewatin-type metavolcanics and metasediments present as small inclusions in the Archean granitic rocks. The granitic rocks underlie the northeastern part of May Township and comprise grey to pink granodiorite and leucogranite with dikes of aplite and pegmatite. Along their southern boundary these granitic rocks are intruded by a body of anorthositic gabbro locally showing compositional banding and similar to rocks previously mapped as part of the Salmay Lake Volcanics (Robertson 1966; 1970) in Salter Township and recognized by Card et al. (1970a; 1970b) in Shakespeare and Dunlop Townships.

Several diabase dikes cut the Archean rocks; some of these were feeders for the anorthositic gabbro, the Huronian volcanics, or the Nipissing Diabase, but the majority are probably late Archean intrusions as they cannot be traced across the Archean-Proterozoic boundary.

After the Archean the area was reduced to a peneplane. Regolith usually found elsewhere in the region is poorly preserved in the map-area.

The Archean rocks are overlain unconformably either by the volcanic rocks and intercalated sedimentary rocks of the Salmay Lake Formation or by the quartzites of the Matinenda Formation. The volcanic rocks are largely massive to porphyritic and(or) amygdaloidal basalt, andesite and diabasic flows with minor pillow lava, and minor rhyodacite. These are interbedded with pyroclastic rocks, greywacke, and quartzite with minor quartz-pebble conglomerate of Matinenda type. The Matinenda Formation overlies Archean basement or the Salmay Lake Formation and comprises feldspathic quartzite, quartz-pebble conglomerate, and arkose, protoquartzite, and greywacke. The pebble conglomerate carries traces of pyrite and uranium.

The Matinenda Formation passes upwards and laterally into the McKim Formation, a sequence of protoquartzite, greywacke, argillite, and feldspathic quartzite (and their metamorphic equivalents), that underlies the greater part of the map-area. Sedimentary structures preserved include lamination, graded bedding, ripple-bedding, and a variety of slumpage structures; features indicative of deposition by turbidity currents.

The Ramsay Lake Conglomerate, believed by Collins (1925) to mark the base of the Huronian, lies conformably on the McKim rocks and outcrops in southern May and Hallam Townships (Robertson and Siemiatkowska 1971a; 1971b). It comprises quartz and plutonic rock fragments sparsely distributed in a gritty quartzite matrix and represents a marine till. Feldspathic quartzite lenses occur in the upper part of the formation.

The Ramsay Lake Formation is overlain by the Pecors Formation, an argillaceous unit similar to the McKim but normally less metamorphosed. The Pecors Formation in turn passes upwards into the Mississagi Formation, which comprises feldspathic quartzite, argillaceous quartzite, and locally orthoquartzite, arkose and quartz-pebble conglomerate. Crossbedding indicates source areas both to the northwest and the northeast. The deposits were beach and deltaic sands, the latter characterized by coarsening upward cycles of rock types.

The Mississagi Formation is disconformably to conformably overlain by the Bruce Formation, a paraconglomerate with a siliceous greywacke matrix bearing pyrrhotite and carbonate. Thin ribs of quartzite are present. The Bruce Formation is interpreted as a water-laid till. The overlying Espanola Formation is an assemblage of carbonates, siltstones, and sandstones showing crossbedding and slumpage structures. A laminated calcareous sandstone lies near the top of the unit. The Espanola Formation grades upwards into the Serpent Formation, a slightly pyritic, well-laminated, feldspathic quartzite locally calcareous. Crossbedding is well developed and indicates both northwest and northeast source areas.

The Serpent Formation is disconformably overlain by the basal beds of the Gowganda Formation comprising interbedded polymictic pebble, orthoconglomerate, and paraconglomerate possibly representing water-laid till.

Structural Geology: The Huronian rocks were subjected to a long deformational and metamorphic history. Throughout much of the map-area, particularly in the McKim Formation, there is evidence of several deformations. The map-area is part of the Penokean fold belt and the events are ascribed to the Penokean and Hudsonian disturbances. The major events are as follows: 1) incipient deformation about east-trending axes; 2) intrusion of Nipissing Diabase, typically as differentiated sills (2,155 million years, Van Schmus 1965); 3) continued deformation resulting in penetrative east-northeast-trending foliation and low- to medium-grade metamorphism; 4) local brecciation of Sudbury type, possibly related to meteorite impact at Sudbury; 5) metamorphism, locally attaining staurolite grade, and renewed deformation with nonpenetrative foliation trending east-northeast and cutting the earlier foliation; folding about east-northeast-trending axes generally plunging east; 6) nonpenetrative foliation trending south of east; 7) open folding with north-south axes; 8) intrusion of olivine diabase dikes of the northwest-trending Sudbury Swarm (1,225 million years, Van Schmus 1965); 9) late faulting striking east-west and northwest. Many of these faults have associated zones of brecciation or of retrograde metamorphism. Regional studies (Robertson 1971) show that the zone adjacent to the Murray Fault system is marked by the presence of volcanic rocks and by marked southward thickening of the Huronian sedimentary units. The zone was probably tectonically active throughout the deposition of the Huronian sediments as well as throughout the deformation during the Penokean-Hudsonian events.

The major structural feature of the area is the Murray Fault, which crosses northern May Township and northwestern Hallam Township. The rocks to the north are little to moderately deformed and metamorphosed; those to the south are moderately to strongly metamorphosed and in central May Township and north-central Hallam Township, strongly deformed. In southern May Township and southeastern Hallam Township both metamorphism and deformation are moderate to weak.

The following units correlate with anomalies on the aeromagnetic maps (ODM-GSC 1963a; 1963b; GSC 1965a; 1965b): the Archean anorthositic gabbro intrusion, the Salmay Lake Formation, the Bruce Formation, and the larger olivine diabase dikes. Sporadic radioactivity anomalies were obtained over arkosic Mississagi Formation in Hallam Township (ODM 1952); corresponding data are not available for May Township.

Economic Geology: The Massey copper belt has been explored since 1900. Sulphide minerals occur as follows: 1) chalcopyrite in Salmay Lake volcanic rocks and Archean anorthositic gabbro; 2) chalcopyrite and (nickeliferous) pyrrhotite disseminated in Nipissing Diabase and in quartz veins adjacent to major faults; and 3) pyrite and(or) pyrrhotite in sedimentary rocks of the Salmay Lake Formation. The principal occurrences (with sparse analytical data) are listed by Moore (1929, p.27-28) and Shklanka (1969, p.247,277,279-280).

Sand, gravel, and clay occur in low lying areas, particularly adjacent to the Spanish River. River and postglacial lake flats support mixed agriculture and cattle grazing. Farming has been on the decline in recent years.

Base metals remain the likely target for prospecting and exploration in the map-area for the foreseeable future.

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No. 24 PANACHE LAKE AREA

DISTRICTS OF SUDBURY AND MANITOULIN

by

K.D. Card[1] and D.S. Innes[2]

Location: The Panache Lake area, Districts of Sudbury and Manitoulin, is bounded by latitudes 45°50' and 46°30'N and by longitudes 81°00' and 82°00'W.

Mineral Exploration: There are several producing nickel-copper mines in the area, including the Crean Hill and Totten mines of The International Nickel Company of Canada Limited; several properties under exploration and development, including the Lockerby Property of Falconbridge Nickel Mines Limited; and numerous past producers and occurrences of base metals and gold. During the field season, the Agnew Lake Mines Limited uranium mine in Hyman Township was closed but surface exploration work was continued. Operations have been suspended at the Spanish River Mines Limited copper mine in Baldwin Township. Silica quarrying operations continued at The International Nickel Company's Lawson Quarry near Whitefish Falls and at Indusmin Limited quarries in the Killarney area. During the 1971 field season, Falconbridge Nickel Mines Limited investigated sulphide occurrences in the Huronian volcanic-sedimentary sequence in Graham Township. Exploration work was carried out in Foster Township to test a cobaltite occurrence and several claim groups were staked in the McGregor Bay area around a known base-metal occurrence.

General Geology: Since most of the map-area has now been mapped, the field work consisted of investigations of problem areas and of measuring stratigraphic sections of most of the Huronian sequence in the area. The sections were measured to determine true thicknesses, insofar as this was possible, and to define lithostratigraphic units in detail. Attention was given to variations in lithology, thickness, and primary sedimentary structures throughout the sequence, and to the nature of contacts between various lithostratigraphic formations.

The basal part of the Huronian sequence between Sudbury and Agnew Lake was investigated in some detail. Mafic and felsic volcanic and sedimentary rocks of the "Frood-Copper Cliff" sequence, greywacke and argillite of the McKim Formation, and sandstone and conglomerate of the Matinenda Formation form a conformable, interfingering basal sequence. In the east, the section consists of about 3,000 feet of thick (100 to 300 feet), commonly porphyritic metabasalt flows with thin intercalations of aluminous (staurolite) metapelite and greywacke. Overlying this is about 2,500 to 3,000 feet of intercalated volcanic and sedimentary rocks which comprise a number of cyclical units ranging in thickness from a few feet to a few hundred feet. The metamorphosed basalt and andesite flows range in thickness from about 10 to 100 feet and individual flows apparently maintain relatively constant thicknesses over large areas. Amygdules are common, and pillows, pillow breccias, and "stirred" (ropy?) tops were distinguished in several localities. The sedimentary rocks include greywacke, argillite, and quartz-rich sandstone. Stratiform, sulphide-bearing (pyrite, pyrrhotite, chalcopyrite) sedimentary rocks and(or) tuffs at the tops of the volcanic members of many cycles characterize this unit. Felsic volcanic rocks, including rhyolitic flows, pyroclastics, and hypabyssal intrusive rocks, form a discontinuous upper member of the volcanic sequence. Flow layering, lithophysae, and clastic textures are present.

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Greywacke, argillite, and quartzite of the McKim Formation conformably and gradationally overlie the "Frood-Copper Cliff" volcanic sequence. The greywacke has thick, graded bedding and ripple-drift crossbedding typical of proximal (relatively near-source) turbidites.

Westward in the basal sequence, there is a general decrease in the volcanic components and concomitant increase in feldspathic sandstone and conglomerate. Argillaceous sedimentary rocks of the volcanic sequence and of the overlying McKim Formation are mainly thin-bedded siltstone and argillite and probably represent distal (far from source) turbidites. In the Agnew Lake area, the sequence consists of a basal unit approximately 600 feet thick of greywacke (tuffaceous material?) and arkose with a few thin mafic flows. This is overlain by about 2,000 feet of interbedded feldspathic sandstone, laminated argillite, and polymictic and oligomictic conglomerates. Thin mafic flows and tuffaceous units are present locally. This sequence passes gradationally upward into siltstone and argillite of the McKim Formation.

There are sill-like, layered gabbro-gabbroic anorthosite bodies at or near the base of the Huronian sequence in Drury and Hyman Townships and in Shakespeare, Dunlop, Porter, and Baldwin Townships (Card and Palonen 1970, p.62). These bodies are generally at the base of the Huronian volcanic sequences, although, locally as at the Agnew Lake Mine, they are found in Huronian sedimentary strata. They intrude the Archean basement rocks and are apparently essentially conformable with the Huronian strata, although the exact nature of the latter contact has not been satisfactorily determined.

Other features of interest include the nature of the contact between the McKim and Ramsay Lake Formations. This contact has been interpreted as the "Great Unconformity" between the Archean and the Proterozoic (Coleman 1914). Detailed investigations show that the two formations are conformable and that locally there is a transition zone up to 100 feet thick of interbedded greywacke, argillite, sandstone, and conglomerate.

The Mississagi Formation is at least 8,000 feet thick in this area, and comprises a number of cyclic repetitions of feldspathic sandstone, quartz greywacke, and siltstone which display distinctive bimodal paleocurrent distribution patterns. The nature of the cycles and character of the paleocurrent patterns possibly indicate deposition in a delta front or marine shelf environment.

Most of the Huronian formations can be subdivided into several lithologic units, several of which are sufficiently distinctive and have great enough continuity to be distinguished as separate formations. For example, the Gowganda Formation should probably be divided to a lower unit some 1,800 feet thick consisting of cyclic repetitions of polymictic paraconglomerate and laminated siltstone, and an upper unit some 1,200 feet thick of interbedded sandstone and siltstone with abundant ripples and slump structures.

Economic Geology: In addition to the well-known nickel-copper deposits associated with the Sudbury Nickel Irruptive and the high-grade silica sources represented by orthoquartzites of the Lorrain and Bar River Formations, there are numerous occurrences of copper, nickel, gold, and cobalt in the area. Most of these are associated with Nipissing-type diabase intrusions and Huronian volcanic rocks. Uranium mineralization is present in the Matinenda Formation at the base of the Huronian sequence at several localities; tungsten occurs in highly metamorphosed rocks of the Espanola Formation in Foster Township; and minor amounts of sulphides are generally present throughout some Huronian units, notably the Bruce Formation.

The "Frood-Copper Cliff" volcanic sequence has many features in common with Archean greenstone belts in which important mineral deposits have been located. These features include a cyclic nature, an overall progression from mafic to felsic extrusive activity, the presence of relatively high-level granitoid plutons (Creighton and Murray Granites), and the occurrence of extensive, stratiform zones of sulphide mineralization. The sequence is worthy of detailed exploration.

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No. 25 PLEISTOCENE GEOLOGY AND INDUSTRIAL MINERAL RESOURCES OF THE SUDBURY AREA

DISTRICT OF SUDBURY

by

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Location: The map-area extends from latitudes 46°30' to 46°45'N and longitudes 80°45' to 81°30'W. The city of Sudbury is located at longitude 81°00'W on the south boundary of the area. Mapping of the western two-thirds of the area was completed in 1970 and checked in 1971. The eastern one-third was mapped during part of the 1971 field season.

General Geology: The area mapped includes the Sudbury volcano-tectonic basin, bounded on the northwest by Archean felsic intrusions and on the southeast by Proterozoic sedimentary rocks. The entire area has been glaciated and the southeastern two-thirds modified by subsequent lake action.

Sandy till occurs in every township in the map-area, although thickness and extent are extremely variable. Where bedrock is exposed, there are striae and grooves caused by ice moving from the north to the northeast. A spillway, presently occupied by the Onaping River and its tributaries, extends into the area from a kame-moraine complex to the northwest. Extensive lacustrine sediments are in the Sudbury basin. These are thickly bedded silts and clays in the central and southern parts of the basin grading into silts and sands on the northern and eastern margins. An extensive sand and gravel deposit of mixed origin occupies parts of Maclennan and Falconbridge Townships. The northeastern half of the complex is the sandy deposits of an ice-blocked tunnel valley which was actively overridden from the northeast by an extremely compact, sandy, bouldery till and thus preserved from subsequent erosion by meltwaters. The southwestern half of the complex is ice-contact deltaic and outwash sands deposited to the east-northeast and slightly deformed by an ice advance from the southwest.

Economic Geology: Present industrial mineral production is most heavily concentrated in the eastern one-third of the basin. Sand and gravel reserves exist in the deposits of Maclennan and Falconbridge Townships on the basin's eastern margin. These occur along a 2-mile wide belt extending from Bowland Bay to the Falconbridge townsite. From Falconbridge to Garson Junction the material is mostly sand sized. At the west of the basin, the Onaping River valley north of Levack has supplied emergency fill for the local mines for several years but available sand and gravel exist on both sides of the river throughout Levack Township. Extensive sand and some gravel deposits are found along the entire length of the Vermilion River from Capreol to Vermilion Lake.

Numerous stone and sand and gravel pits have been opened around the Sudbury Basin. Producing pits are located in the townships of Maclennan, Falconbridge, Capreol, Garson, Hanmer, Balfour, Levack, and Dowling.

Structural mineral production during 1969 for the Sudbury area was as follows: 4,713,560 tons of sand and gravel valued at $2,314,353; 791,674 tons of quartz valued at $341,453 (Statistical files, ODMNA, Toronto).

No. 26 RIVER VALLEY AREA

DISTRICTS OF SUDBURY AND NIPISSING

by

S.B. Lumbers[1]

Location: The River Valley area covers about 750 square miles northeast of the city of Sudbury between longitudes 80°00' and 80°45'W. The southern boundary is latitude 46°30'N, and the northern boundary extends eastward from the southeastern end of Wanapitei Lake along the northern boundary of the townships of Scadding, Davis, McNish, and Pardo to the southern end of Lake Timagami in Vogt Township. Reconnaissance mapping of all but a small part of the area at a scale of 1 inch to 1 mile was completed during the 1971 field season.

Mineral Exploration: Deposits of iron, copper, nickel, lead, zinc, gold, uranium, garnet, feldspar, building stone, and sand and gravel have been explored and utilized in the River Valley area, but present production is confined to building stone and to sand and gravel. Recent exploration activity has centred upon widespread copper and nickel mineralization in anorthositic and gabbroic intrusions, and upon building stone and garnet deposits.

General Geology: Rocks of the Superior, Southern, and Grenville Provinces of the Canadian Precambrian Shield underlie the area. The Grenville Front tectonic zone (Lumbers 1970; 1971a), separates predominantly Middle to Late Precambrian rocks of the Grenville Province in the southern part of the area from Early Precambrian rocks of the Superior Province and Middle Precambrian rocks of the Southern Province in the northern part of the area. A boundary fault marking the only mappable northern extremity of the Grenville Province (Lumbers 1971a) extends northeastward from the southwestern part of Dryden Township, diagonally across Street Township, and eastward from the northeastern part of Street Township through the southern parts of Davis and Janes Townships. At the east boundary of Janes Township, the boundary fault abruptly changes direction to north-northeast and extends through the western part of Dana Township to Weever Lake in east-central Pardo Township. From Weever Lake, the fault boundary again changes direction to east-northeast and extends across central Hobbs Township and the northwestern part of McCallum Township and thence into the adjacent Tomiko area (Lumbers 1971b; 1971c). Rocks of the Superior Province are confined to the northeastern parts of Pardo, Hobbs, Vogt, Torrington, and McCallum Townships and are overlain unconformably by Middle Precambrian sedimentary rocks of the Huronian Supergroup that underlie the region adjacent to the Grenville Province from Pardo Township to the western boundary of the area. All of these rocks are intruded by Nipissing Diabase and associated granophyre and felsite. The Grenville Province is underlain mainly by high-rank metamorphic metasedimentary gneiss, anorthosite-suite intrusive rocks, minor granitic and mafic intrusive rocks, and late granite pegmatite dikes. Most of the metasediments are locally migmatitic due to partial melting during high-rank regional metamorphism, and most of the intrusive rocks predate the high-rank regional metamorphism and are thus recrystallized and gneissic. Late Precambrian and possibly younger diabase dikes cut across the Early and Middle Precambrian rocks north of the Grenville Front, and late dikes of diabase and lamprophyre are present in the Grenville Province rocks. The area was subjected to Pleistocene continental glaciation.

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The Early Precambrian succession consists of isoclinally folded mafic and felsic volcanic rocks, greywacke, and minor iron formation regionally metamorphosed under greenschist facies conditions and intruded and contact metamorphosed by granitic rocks and a few mafic dikes and sills. Iron formation and most of the metavolcanics are confined to Vogt Township where they were mapped previously by Grant (1964), but a thin unit of felsic pyroclastic rocks is interbedded with metagreywacke on the south side of Deschamps Lake in Pardo Township. Most of the granitic rocks intruded metagreywacke adjacent to the Grenville Province, and together with inclusions and screens of metagreywacke, the granitic rocks can be traced up to 3 miles into the Grenville Province where all these rocks were subjected to high-rank regional metamorphism.

In the Southern Province, the oldest rocks exposed are a complex assemblage of arkose, protoquartzite, argillite, orthoquartzite, medium- to coarse-grained quartzo-feldspathic sandstone with quartz pebbles, conglomerate characterized by rounded quartz clasts and a pyrite-bearing matrix, minor greywacke, marble, and coarse-grained pebbly to bouldery arkose and a few felsic to mafic volcanic units. This assemblage underlies rocks of the Gowganda and Lorrain Formations in a folded basin in eastern Scadding, Davis, and the western parts of Janes and McNish Townships. Previous workers were uncertain of the relative age of this pre-Gowganda assemblage, and many assigned it partly to the Sudbury Group and partly to the Huronian Supergroup. Many of the rocks of the assemblage assigned to the Sudbury Group have been intensely deformed and metamorphosed near the Grenville Front. In northwestern Pardo Township, the assemblage is only slightly deformed and metamorphosed, and unconformably overlies Early Precambrian granitic rocks and isoclinally folded metagreywacke of the Superior Province; in McNish, Janes, and Scadding Townships, the assemblage locally grades through a facies change into the overlying Gowganda Formation. Locally in Scadding Township slump breccias with large blocks of quartz-rich sandstone of the assemblage mark the base of the Gowganda Formation. Within 1 mile of the Grenville Front, rocks of the assemblage are isoclinally folded, intensely cataclastic, and more recrystallized than elsewhere.

Nipissing Diabase intrusions, locally, have poorly developed igneous layering and contain disseminated chalcopyrite, pyrite, and pyrrhotite, particularly in Janes Township where irregularly shaped stocks of granophyre and felsite intrude the diabase. These felsic intrusions, which are perhaps among the largest recorded in association with Nipissing Diabase, seem to be a late phase of the diabase and are concentrated in the vicinity of the abrupt change in strike of the Grenville Front in eastern Janes and western Dana Townships. A small felsite body also intrudes Nipissing Diabase east of Outlet Bay, Lake Wanapitei, in Scadding Township.

Early Precambrian rocks of the Superior Province that extend locally into the Grenville Province in Pardo, Hobbs, and McCallum Townships are unconformably overlain by a coarse clastic metamorphosed sequence of coarse-grained arkosic sandstone, coarse-grained pebbly sandstone, conglomerate, and minor finer grained sandstone and siltstone. This sequence extends southwestward into central Crerar Township and is a continuation of the coarse clastic sequence mapped previously in the Tomiko area (Lumbers 1970; 1971b; 1971c). The sequence seems to form the base of the sedimentary accumulation in the Grenville Province and its primary lithology resembles some facies of the pre-Gowganda metasediments in the adjacent Southern Province; perhaps the coarse clastic sequence may also be pre-Gowganda in age. To the south, the sequence shows a facies change into coarse-grained micaceous metasandstone and biotite gneiss probably derived from greywacke. To the west a large anorthosite complex cuts off the sequence from finer grained clastic metasediments.

The large anorthosite complex extends from southwestern McWilliams and northwestern Gibbons Townships into Dana and southwestern Pardo Townships and westward parallel to the Grenville Front through northern Crerar Township, most of Henry and Loughrin Townships, and into western Street, northern Awrey, and northeastern Dryden Townships. The complex is extremely irregular in outline and extends across the Grenville Front in Dana and southwestern Pardo Townships where it intruded metasediments of the Huronian Supergroup and Nipissing Diabase and associated granophyre. A large eastern lobe of the complex, covering about 50 square miles in southeastern Janes, northeastern Henry, northern Crerar, Dana, McWilliams, and Gibbons Townships, is discordant and elliptical in plan with a northern arm extending into southwestern Pardo Township and across the Grenville Front. To the west in northern Henry Township, a narrow neck of gabbroic anorthosite, less than 1/4 mile across, connects the eastern lobe with the remainder of the complex, consisting of several, irregularly shaped, branching arms resembling an octopus. Although foliation in the host metasediments is generally concordant with contacts of the western part of the complex, numerous local discordant relations exist, and this western part probably represents a relatively high section near the roof of the complex. Most of the complex in the Grenville Province was recrystallized by the high-rank regional metamorphism and is gneissic, but some parts of the eastern lobe are massive with primary mineralogy. That part of the complex extending across the Grenville Front is cataclastic, locally massive, and was subjected to low-grade metamorphism. The eastern lobe consists of massive to gneissic, medium- to coarse-grained anorthosite, and gabbroic anorthosite, and minor anorthositic gabbro, gabbroic to dioritic rocks, tonalite, ultramafic rocks, fine-grained mafic dikes, and dikes and irregularly shaped bodies of syenitic to granitic rocks. An irregularly shaped, discordant stock of massive to gneissic, syenitic to granitic rocks at the northern margin of the lobe in Dana and McWilliams Townships may be a late phase of the complex. Poorly developed primary igneous layering with olivine-bearing mafic layers is present locally, and some massive anorthosite is black due to abundant ilmenomagnetite. The gneissic western part of the complex is similar in lithology to the eastern lobe but slightly more mafic and contains more anorthositic gabbro, gabbroic to dioritic rocks, tonalite, and syenitic to granitic dikes; ilmenomagnetite-rich black anorthosite is absent and a few late dike phases of anorthositic gabbro are massive with primary mineralogy. Locally near the southern contact of the eastern lobe in Crerar Township, border phases of the complex consist of breccias with undeformed, angular, gabbroic fragments in a fine-grained anorthosite matrix;

elsewhere border phases of the complex are more mafic and finer grained than the interior phases. In the central part of one of the numerous branching arms of the western end of the complex, a peculiar diatreme-like breccia cuts gneissic gabbroic anorthosite and contains angular to rounded quartz-rich metasandstone fragments and rounded to embayed anorthosite fragments in a fine-grained mafic matrix containing garnet. Late undeformed dikes and small stocks of mafic to ultramafic rocks are concentrated within and nearby the anorthosite complex, particularly in the western part, and are probably genetically related to the complex. A relatively positive regional gravity anomaly (Popelar 1971) is centred over the complex.

The general features of the complex outlined plus other data indicate that it was possibly emplaced at a relatively high crustal level during the waning stages of the high-rank regional metamorphism in the Grenville Province. Most anorthosite-suite intrusions in the Grenville Province are generally thought to be emplaced at relatively deep crustal levels so that this complex is extremely important in gaining a better understanding of the genesis of the anorthosite suite. Moreover, because the complex partly straddles the Grenville Front and seems to be older than the major deformation along the Grenville Front, it gives some qualitative data on the magnitude of relative displacement along the Grenville Front boundary fault. No appreciable lateral displacement of the complex is apparent at the fault, and because the complex has features indicative of emplacement at a relatively shallow crustal level on both sides of the fault, the magnitude of vertical displacement may also be small in spite of a marked contrast in regional metamorphic grade across the fault. Other data from the adjoining Tomiko and Burwash areas (Lumbers 1971b; 1971c; 1971d; 1971e) indicates no appreciable lateral displacement and relatively small vertical displacement at the Grenville Front boundary fault.

Structural Geology: Rocks of the Southern and Superior Provinces within two miles of the Grenville Front boundary fault are cataclastic, locally mylonitized, and compressed into isoclinal folds overturned towards the Grenville Province. This deformation is superimposed upon earlier, relatively open folds in the Middle Precambrian rocks and upon upright isoclinal folds in the Early Precambrian metasediments and metavolcanics, and is most extensive in Janes and Dana Townships where the Grenville Front changes strike abruptly. In the Grenville Province the metasedimentary gneisses are complexly folded with foliation surfaces dipping mainly southeastward. A prominent rodding lineation in the plane of foliation is present in most of the gneisses in all but the southeastern part of the area. Fold patterns seem to reflect complex multiple phases of folding with large recumbent folds common throughout the Grenville gneisses and dome and basin structures common in the southeastern part of the area. The abrupt change in strike of the Grenville Front in Janes and Dana Townships seems to be caused by deflection about an older structure, possibly a basin, now largely masked by the anorthosite complex, but reflected in the stratigraphy of the rocks of the Huronian Supergroup.

The area contains numerous faults forming two major systems: 1) a north to northeast system, and 2) a west to northwest system. These two systems are also present in the adjacent Tomiko area (Lumbers 1970; 1971b; 1971c), and faults of both systems are marked by prominent zones of granulation and mylonitization. All the faults underwent late movement relative to the culmination of the Grenville regional metamorphism and faults of both systems displace the Grenville Front boundary fault. Faults of the north to northeast system rarely extend south of the Grenville Front tectonic zone, and most extend for only a short distance north of this zone. Some faults of the west to northwest system extend across the map-area and can be traced over long distances into adjacent regions. Other faults of this system in rocks of the Huronian Supergroup end abruptly at the Grenville Front. Diabase dikes in the area are associated with faults of the west to northwest system and some dikes underwent further faulting following their emplacement.

The Crystal Falls Fault, a northwest-trending structure marking the northern margin of the Ottawa-Bonnechere graben in the northwest part of the North Bay area (Lumbers 1971f), seems to continue northwestward into the River Valley area along the Sturgeon River to the northwestern part of Crerar Township. Rock exposure is poor near the assumed trace of the fault, but one outcrop near the Sturgeon River in eastern Crerar Township contains a few, narrow, *en echelon* lamprophyre dikes similar to those of Cambrian age near the fault in the North Bay area.

Economic Geology: Iron mineralization is confined mainly to Early Precambrian iron formation in Vogt Township mapped and described by Grant (1964). Local concentrations of ilmenomagnetite (intergrowth of ilmenite and magnetite) in black anorthosite in the eastern lobe of the anorthosite complex described above have not been explored, although some of the black anorthosite is quarried for building stone. As much as 15 percent disseminated ilmenomagnetite is present in the black anorthosite.

Copper and minor nickel mineralization are confined mainly to Nipissing Diabase intrusions and to the anorthosite complex. Nipissing Diabase in Janes and Davis Townships has been explored extensively in recent years by surface trenching and stripping, diamond drilling, and geophysical surveys in the search for low-grade copper-nickel deposits. The most recent work was done by S. Christie in 1969 and 1970, Foster Lake Mines Limited in 1969, Kennco Explorations (Canada) Limited in 1969 and 1970, Kirkland Townsite Gold Mines Limited in 1968, Mid-North Engineering Services Limited in 1970, Movado Mining Company Limited in 1967 and 1968, Ossington Explorations Limited in 1968 and 1969, E.J. Rivers in 1969 and 1970, and Triller Exploration Limited in 1968 and 1969. Mineralization in the Nipissing Diabase intrusions consists mainly of disseminated chalcopyrite, pyrrhotite, and pyrite. Some of the mineralization is in shear zones with quartz vein stockworks and local pockets of massive sulphides, and some is in relatively massive diabase. The mineralized zones occur either in the intrusions or near their contacts. Analytical results from several mineralized zones reported by the various companies in assessment work filed with the Resident Geologist's office, Ontario Department of Mines and Northern Affairs, Sudbury, indicate that, although copper concentrations locally exceed one percent, most are less than one percent, and nickel rarely exceeds one percent and is generally less than 0.5 percent. Minor gold, silver, lead, and zinc mineralization is also reported from a few mineralized zones. Insufficient data are available to determine the size and shape of the mineralized zones reported.

Copper and minor nickel and gold mineralization has been explored in the eastern lobe of the anorthosite complex. In 1969, Kennco Exploration (Canada) Limited explored sparsely disseminated sulphide mineralization in cataclastic rocks of the complex along the western and southern sides of Dana Lake, Dana Township, by surface trenching. The main area of known mineralization is in Crerar Township near the southern contact where, between 1961 and 1970, Tomrose Mines Limited and Falconbridge Nickel Mines Limited explored a large area west of Sturgeon River by surface trenching and stripping, diamond drilling, and geophysical surveys. Disseminated chalcopyrite, pyrite, and pyrrhotite occur in fractured anorthositic gabbro, gabbro, and irregularly shaped ultramafic layers in gabbroic anorthosite. Some mineralization is also reported by Tomrose Mines in fractured metasediments at the contact of the complex and in quartz veins in the complex. The brecciated border phases of the complex described above occur in the vicinity of the mineralization and further work could show that the mineralization was introduced into brecciated and fractured parts of the complex. In their prospectus, Tomrose Mines report copper concentrations ranging from a fraction of one percent to over 10 percent, nickel concentrations generall[illegible]s than 0.5 percent, and traces of gold.

Disseminated to massive copper, lead, and minor zinc mineralization in the form of chalcopyrite, galena, and sphalerite is found in quartz and quartz-carbonate veins associated with faults of both the north to northeast system and the west to northwest system in the Southern Province part of the area. Pyrite, minor arsenopyrite, gold, and silver mineralization is also present in some of the veins. The known mineralized veins are perhaps most abundant within a few miles of the Grenville Front, but the mineralization found to date seems to be too irregularly distributed and too small to be of economic value.

Uranium mineralization occurs in pyritized quartz pebble conglomerate forming the base of the pre-Gowganda assemblage in Pardo Township in the vicinity of Tee and Silver Lakes. This mineralization has been described by Thomson (1960).

Garnet deposits near the contact of the anorthosite complex have been explored in Dana and Loughrin Townships. In Dana Township, garnets up to 4 inches across in metasediments were extracted several years ago for use as an abrasive. In 1969, K.A. Davis reexamined this deposit by surface stripping and trenching.

Late granitic pegmatite dikes in various parts of the Grenville Province part of the area have been explored as a possible source of feldspar. A few thousand tons of feldspar were produced in the 1920s from deposits in Loughrin, Davis, and Crerar Townships.

Black and grey anorthosite of the anorthosite complex is quarried for building stone by Erana Mines Limited near the northwest corner of Gibbons Township. Other localities in the eastern lobe of the complex in Dana and McWilliams Townships have also been explored for building stone but no production is reported.

Relatively thick deposits of sand and gravel south of the Wanapitei River in Dryden and Awrey Townships are used extensively for local construction purposes in the Sudbury area.

Suggestions for Future Exploration: A regional positive gravity anomaly partly underlying the River Valley area (Popelar 1971) is centred upon an anorthosite complex apparently emplaced at relatively high crustal levels where the

Grenville Front shows an abrupt change in strike from east-northeast to north-northeast. Possibly the Grenville Front is deflected around an older basin structure now partly obscured by the later geological events, but suggested by the stratigraphy of the Huronian metasediments. Rocks of the Southern Province near this major change in strike of the Grenville Front are intensely deformed over a large area in Janes and Dana Townships and unusually large granophyre intrusions are associated with bodies of Nipissing Diabase. In this setting, copper and minor nickel mineralization is widespread in the intrusions and in the deformed country rocks. Although parts of this area have been extensively explored recently, the present study indicates that further work is justified and should be expanded to include the entire anorthosite complex.

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No. 27 QUATERNARY GEOLOGY, DUNDALK AREA

SOUTHERN ONTARIO

by

Q.H.J. Gwyn[1]

Location: The map-area is bounded by latitudes 44°00' and 44°15'N and longitudes 80°00' and 80°30'W. The two principal settlements are the town of Shelburne, in the centre of the area, and the town of Dundalk in the northwestern part of the map-area. Mapping was initiated and completed in the summer of 1971, and comprised the Dundalk map sheet (NTS 41A1).

General Geology: The west half of the map-area forms part of the Dundalk till plain (Chapman and Putnam 1966, p.204) on which, in the western part, flutings and drumlins have a southeastward trend. This indicates that they were formed by the ice of the Huron lobe or Georgian Bay lobe, or both together. In the central part, flutings and till pebble orientation have a southwest trend, probably the result of the movement of the Georgian Bay or Lake Simcoe lobes.

Overlying the till plain are three large eskers formed by meltwater flowing southeastward. These are from north to south: the Shrigley, Riverview, and Keldon Eskers. As well as the eskers, low lying areas in the till plain are covered by a veneer of sandy outwash which was deposited in local meltwater channels that flowed southward into Grand River.

The eastern half of the area includes a section of the Niagara Escarpment upon which part of the Orangeville and possibly the Singhampton Moraines have formed. The escarpment runs north from Mono Centre to Kilgorie and Ruskview. It is capped by dolostone of the Amabel Formation of Silurian age. The Silurian section at Hornings Mills has been described by Bolton (1957). The Amabel Formation also underlies the western half of the area. East of the Escarpment, shale and siltstone of the Queenston Formation (Ordovician age) are exposed at several localities.

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The Orangeville Moraine runs southward from Honeywood, where it may join the Singhampton Moraine, through Whitfield, Primrose, and just east of Mono Centre. The moraine is nearly completely composed of sand, pebbly sand, and gravel. There is a capping of till in an area around Whitfield. A second morainic area is east of the Orangeville Moraine, and is separated from the Orangeville Moraine by the Violet Hill spillway (Chapman and Putnam 1966, p.65). It is not known whether it is a separate moraine or part of the Orangeville Moraine.

The Violet Hill spillway was formed at two distinct elevations: one at 1,425 feet and a second at 1,350 feet. At the higher level two deltas formed: one at Hornings Mills and the other at Black Bank. The deltas are composed predominantly of coarse gravel outwash, as are most of the deposits in this upper spillway level. The deposits in the lower level of the spillway are nearly always sand or pebbly sand. Other areas underlain by outwash, as in Nottawassaga Valley and Pine Valley, contain very large amounts of sand, pebbly sand, and smaller amounts of gravel in surface exposures.

Economic Geology: Only one stone quarry has operated within the Dundalk area. Ritchie Cut Stone Limited quarried dolostone of the Amabel Formation 1.5 miles east of Shelburne in the late 1920s (Goudge 1938, p.214).

The gravel in eskers in the west and central parts of the area are the main source of this material presently being developed. The eskers contain sufficient gravel for local requirements only. Very large reserves of sand and gravel are found principally in Mono, Mulmer, and in the southeastern part of Melancthon Townships. There is a sufficient supply to support several commercial operations. Finally, there is an undetermined amount of ice-contact sand and gravel which is buried by till. Several exposures were examined in which till overlies sand or gravel. These were located both in the extreme eastern and western edges of the map-area.

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northeast which resulted in the deposition of a silty till.

Events west of the Orangeville Moraine are not yet known. Glaciolacustrine sediments overlie much of the till sheet west of the Orangeville Moraine. These sediments are usually not thick and represent local pondings rather than a large proglacial lake.

Economic Geology: Quarrying of sandstone and dolomite was formerly carried out in the Orangeville area but not at the present time. Sand and gravel extraction is primarily for local requirements. Two major outwash deposits occur in the area, which represent a sizeable sand and gravel resource. The first of these is an outwash sheet fronting the Paris Moraine in a 1- to 3-mile wide band between Erin and Highway 10. Though much of this gravel is proximal facies and, therefore, somewhat flaggy and dirty, this deposit must be considered as an important future reserve. The second area containing an important future reserve occurs in an area bounded by Highways 9 and 10, the second concession east of Hurontario Street in Mono Township, and a line about 1 mile south of the northern edge of the map-area. Gravel in this deposit may exceed 50 feet in thickness in places.

Granular resources suitable for local needs occur in pockets in the Orangeville Moraine and in small outwash deposits.

No. 29 PLEISTOCENE GEOLOGY AND INDUSTRIAL MINERAL RESOURCES OF THE NIAGARA AREA

SOUTHERN ONTARIO

by

B.H. Feenstra[1]

Location: The Niagara area extends from latitude 43°00'N to Lake Ontario and from the Niagara River to longitude 79°30'W. The city of St. Catharines is in the north-central part of the map-area.

The surficial geological mapping at a scale of 1:50,000 has been completed.

General Geology: The Pleistocene surficial deposits found predominantly throughout the area are Late Wisconsinan in age and may be correlated with the glacial advance that deposited Halton Till and with Warren and post-Warren glacial lakes in the Erie and Ontario Basins.

Halton Till varies in texture from a silt to clay till. It occurs below Lake Iroquois sediments in the Lake Ontario shore bluff, is exposed throughout much of the Lake Iroquois plain as well as in its shore bluff west

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No. 28 QUATERNARY GEOLOGY, ORANGEVILLE AREA

SOUTHERN ONTARIO

by

W.R. Cowan[1]

Location: The map-area is bounded by latitude 43°45' to 44°00'N and by longitude 80°00' to 80°30'W. The town of Orangeville is located near the centre of the eastern half of the area.

Mapping of the eastern half of the area was completed during the 1971 field season as was a part of the western half. Reconnaissance and sampling of surface till was carried out over the remainder of the western half of the area.

A brief report on landslide hazard in the Hockley Valley was prepared.

General Geology: Ordovician shales of the Queenston Formation outcrop between Brimstone and Cataract and in the Nottawasaga River valley and its tributaries. Sandstone, dolomite, and limestone of the Clinton and Cataract Groups of the Silurian occur southeast of Canning Falls, 2 miles northeast of Orangeville, and between Cataract and Belfountain. Silurian dolomite of the Amabel Formation outcrops in the Cataract-Belfountain area, 1 mile northeast of Erin, in the Alton-Melville area, 1 mile east of Orangeville, in the Canning Falls area, and in the Escarpment area east of Blount. Silurian dolomite of the Guelph Formation outcrops along the Grand River valley.

Surficial deposits consist mainly of Late Wisconsinan tills, sands, and gravels. The oldest till is the Catfish Creek Till (Tazewell) which is present throughout much of southern Ontario. Outcrops believed to relate to this stratigraphic unit are near Hillsburgh, in the Grand River valley as far north as Grand Valley, and in the Conestoga River valley in the western part of the area. The next youngest tills observed occur east and west of the bulky Orangeville Moraine. The till flanking the west side of this interlobate feature is a silt to sandy silt till, which directly overlies the Catfish Creek Till in many places, and which had a source from the northwest. The Orangeville Moraine is interpreted to be of Cary age. The till flanking the east side of the Orangeville Moraine is a sandy till occurring as a 3- to 5-mile wide band east of the moraine. Much of this till overlies stratified drift which apparently represents an earlier more easterly extension of the Orangeville Moraine. Overriding of this older drift resulted in the deposition of the sandy till, much of it in the form of drumlins; the formation of the present Orangeville Moraine; and the formation of the Hillsburgh meltwater channel. Retreat of the ice from the east side of the Orangeville Moraine was followed later by advance to the Paris Moraine east of Erin by Ontario Lobe ice and the deposition of the Wentworth Till associated with this moraine. A post-Orangeville Moraine advance also took place in the of St. Catharines, and from the latter to a very short distance beyond the Vinemount Moraine west of Twenty Mile Creek. Initially the glacier advanced in a southwesterly direction beyond the southern boundary of the map-area. Excavations for the relocation of the Welland Canal between Port Robinson and Ramey's Junction reveal the presence of two tills below and separated by glacial-lake sediments. Several ice-marginal positions occur in the map area: 1) the Vinemount Moraine, reworked by lake waters on its distal side; 2) the delta at Fonthill; 3) the delta south of St. Davids; 4) possibly the Niagara Falls Moraine, which is covered by glacial-lake sediments. These positions cannot be definitely traced throughout the area.

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Most of the Niagara area is covered by glacial-lake clays, silts, and fine sands. The presence of post-Whittlesey and pre-Iroquois lake levels is recorded by short beaches, deltas, and wave-cut features at elevations between 850 and 612 feet. The short multiple beach ridges found at elevations between 850 and 825 feet as well as a wave-cut terrace and scarp at 810 feet to the west of Fonthill are believed to be evidence for the existence of at least two Warren levels. A spit with recurved ridges east of Fonthill at an elevation of 640 feet may be a feature of Lake Dana. The shoreline of Lake Iroquois along Highway 8 is the most continuous Pleistocene shoreline in the area. It is mainly an erosional bluff. However, a large bar consisting of beach sand and gravel extends through St. Catharines from Homer to Twelve Mile Creek and thin beach deposits occur at several localities between St. Catharines and Beamsville. Various small ridges of sand and gravel are present below the Iroquois shoreline in the eastern part of the area.

Economic Geology: The main commercial sources of sand and gravel are limited to the deltaic deposits located at Fonthill and south of St. Davids. These deposits are worked by Moyer Sand (1965) Limited and Telephone City Gravel Company Limited at Fonthill, and by St. Davids Sand and Gravel Limited, Braas Brothers, Calaguiro Brothers, and Allen Brothers (in the Half-Way sand pit) south of St. Davids.

Queenston shale exposed in the Iroquois plain northwest of St. Davids is used for the manufacture of brick by Burnstein Brick Limited of St. Catharines. The Lockport Formation is quarried for building stone west of Queenston and primarily for aggregate at Thorold, St. Catharines, south of Vineland, and south of Beamsville.

The total reported mineral production in 1969 amounted to $5,376,971 (Statistical files, ODMNA, Toronto).

No. 30 QUATERNARY GEOLOGY OF THE WINDSOR-ESSEX AREA SOUTHERN ONTARIO

by

U.J. Vagners[1]

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Location: The region mapped is bounded by Lake Erie, Detroit River, Lake St. Clair and longitude 82°30'W. The city of Windsor is located in the northwestern part of the area. The mapping was initiated during the 1970 field season and was completed during the summer of 1971.

General Geology: The area is underlain by Middle Devonian limestone, dolomite, and shale and by Upper Silurian dolomite. The bedrock is found exposed in quarries and excavations in the southwestern part near Amherstburg and on the islands in Lake Erie. In the rest of the map-area the bedrock is mantled by a thick layer of Quaternary sediments.

The Quaternary deposits in the area may be subdivided into Pleistocene and Recent. Sediments deposited during the Pleistocene Epoch consist of till, glaciofluvial sand, and gravel, and glaciolacustrine gravel, sand, silt, and clay. Two types of till have been identified; a clayey silt till is the most common Quaternary sediment and is found in almost all the region with the exception of an area in the southwestern part in the Amherstburg to Harrow area, where a sandy silt till is exposed. Glaciofluvial sand and gravel are found in the following areas: 1) Leamington-Ruthven-Cottam-Essex-Albuna area; 2) Kingsville area; 3) Harrow-Amherstburg area; 4) Edgars-Roseland area.

Although all of the area mapped has been under lacustrine conditions during at least part of the Pleistocene Epoch glaciolacustrine sediments are not common. Major sand and gravel deposits related to glacial lakes occur in the areas listed: 1) Leamington-Ruthven-Olinda; 2) Albuna; 3) Kingsville; 4) Oxley-Harrow; 5) River Canard-Windsor-Lukerville. Glaciolacustrine silt and clay are located near Leamington, at Arner, and in the southern part of Sandwich West Township.

Sediments deposited during the Recent Epoch include: beach sand and gravel along the present shorelines of Lake Erie and Lake St. Clair; alluvium found on the flood plains of the major rivers and streams; and organic material accumulated in the present swamps. Some of the sand of lacustrine and glaciolacustrine origin has been reworked by wind into dunes on Point Pelee and east of Leamington.

Mineral Production: The total value of mineral production for Essex County in 1969 was $12,811,112 consisting of salt, lime, limestone, sand and gravel, clay, petroleum, and natural gas (Statistical files, ODMNA, Toronto).

Following are some of the companies producing industrial minerals in the map-area in 1969 (Statistical files, ODMNA, Toronto):

Company	Product
The Canadian Rock Salt Co.	Salt
Allied Chemicals Canada	Salt
Canada Salt Co.	Salt
Broadwell, B. & Son	Clay
Comber Tile Yard	Clay
Allied Chemicals Ltd.	Limestone
Amherst Quarries Ltd.	Limestone
Allied Chemicals Ltd.	Lime
Erie Sand & Gravel	Sand and Gravel
Kennette Construction Co. Ltd.	Sand and Gravel
Spinks Gravel Ltd.	Sand and Gravel
Ontario Lake Erie Sand	Sand and Gravel

The salt is produced from Silurian strata by underground mining at Windsor and by brining operations at Amherstburg and Windsor. Limestone and dolomite is produced from quarries in Devonian bedrock situated in Malden and Anderdon Townships where the Quaternary sediment cover is thinner. Sand and gravel is extracted from pits in glaciofluvial and glaciolacustrine sediments in Gosfield South and Mersea Townships and is dredged from Recent deposits of Lake Erie in Marsea Township. Clay is obtained from pits in weathered till in Gosfield South and Tilbury West Townships. Petroleum and natural gas is tapped from reservoirs in Devonian, Silurian, and Ordovician strata.

No. 31 MAGNETIC BASE STATIONS IN ONTARIO

by

Wooil Moon[1]

A network of magnetic base stations was established throughout northeastern Ontario during the 1971 field season. The purpose of establishing magnetic base stations was to provide a common magnetic base-level for regional and detailed magnetic surveys by the mining industry and other institutions. The area of about 12,300 square miles, bounded by latitudes 47°30' and 49°00'N and by longitudes 79°30' and 82°00'W, was covered by the network of 70 magnetic base stations. Total force readings were tied to the value of the magnetic observation repeat station of New Liskeard (Dominion Observatory Station) and vertical force readings to the 1,000 gamma value selected by R.S. Middleton (1968) for the Ontario Department of Mines and Northern Affairs Bristol-Ogden magnetic base station.

The instruments used were one sharp MF-1-100, two McPhar M-700 vertical field magnetometers and a Barringer GM-102 total field magnetometer. Diurnal variations in the earth's magnetic field were corrected by utilizing a Rustrak 88 recorder connected to a McPhar M-700 magnetometer. The maximum relative and absolute errors in the magnetic field readings on each station are presently estimated as ± 20 gammas and ± 50 gammas.

The continuous variation of the earth's magnetic field and the secular variation make the establishment of a magnetic base station obscure at the moment a magnetic field value is given to the station. However, the field values given to each station were obtained in a short time period with proper diurnal correction, and, for the regional magnetic survey, these values are considered to be adequate. For earth physics studies, these base stations may not provide appropriate information.

The following considerations were made in choosing the locations of each base station: 1) a low regional magnetic field gradient; 2) a regionally low magnetic field; 3) economic significance of the geological environment, e.g. "greenstone" belt vs. a granite-gneiss area; 4) ease of access to station;

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5) the recommendations of the Ontario Department of Mines and Northern Affairs Resident Geologists, E.G. Bright in the Timmins office and H.L. Lovell in the Kirkland Lake office. At each base station a cement block, 1 foot by 1 foot by 1/2 foot with an aluminum medallion on top, was placed and the trees in the surrounding area were blazed and painted red for easy identification.

During the 1971 field season, nine magnetic base stations also were established in the Sioux Lookout, Sturgeon Lake, and Savant Lake areas to provide a common Ontario Department of Mines and Northern Affairs magnetic base-level for northwestern Ontario. These nine magnetic base stations cover two major "greenstone" belts; in the Vermilion Lake-Minitaki Lake area and the Sturgeon Lake-Savant Lake area, where metamorphosed volcanic and sedimentary rocks of Archean age form two separate synclinal structures. The total magnetic field values were tied to the total magnetic field level for northeastern Ontario, Ontario Department of Mines and Northern Affairs magnetic base stations. The vertical field values were not tied to those of the northeastern Ontario magnetic base-level, however, since the total magnetic field in northwestern Ontario is 1,000 gammas to 2,000 gammas higher than that in northeastern Ontario and the vertical field values in northwestern Ontario relative to the northeastern Ontario, Ontario Department of Mines and Northern Affairs base-level were not considered to be appropriate. A new assumed vertical magnetic field value of 1,000 gammas was established at the Sturgeon Lake Ontario Department of Mines and Northern Affairs base station, Lumberjack Lodge on Sturgeon Lake. Eight other base stations in the region were tied to this station.

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No. 32 INDUSTRIAL MINERAL STUDIES IN SOUTHERN ONTARIO

by

M.A. Vos[1]

In the summer of 1971 time spent in the field was devoted to several projects. They include: 1) Ordovician Limestone Resources of Southern

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Ontario; 2) Devonian Limestone Resources of Southern Ontario; 3) Clay Products Industry of Ontario; 4) Special Projects.

Ordovician Limestone Resources of Southern Ontario: The Ordovician limestone resources of southern Ontario are of economic importance for the production of both aggregate and cement. As producers of aggregate the Beekmantown Dolomite and the Trenton-Black River Limestones gain in importance as the supply of unconsolidated material diminishes. Crushed rock has an advantage over waterworn gravel where angularity of the material is required. Good concrete aggregate is produced in several quarries in the Beekmantown Dolomite. The largest three of these quarries are located in South Gloucester Township, 9-1/2 miles southeast of Ottawa, and along the St. Lawrence River in Brockville and Iroquois. A new quarry was recently opened in the Ottawa area by Bertrand & Frère Construction Company Limited. Total production from Beekmantown Dolomite amounted to 1,168,005 tons in 1969 (Statistical files, ODMNA, Toronto).

Production of aggregate from the Trenton-Black River Limestones is concentrated in the Ottawa, Kingston, and Cornwall areas. West of Kingston there is production of aggregate as well as cement. Cement is produced primarily from sections of Trenton Limestone including shaly parts. Shale supplies some or all of the required alumina and silica thus reducing or eliminating addition of sand or clay to the kiln feed. In September 1971, in Bath, a new quarry and cement plant were officially opened by Canada Cement Lafarge Limited.

Most of the cement in Ontario, totalling about 3.5 million tons in 1970 valued at approximately 63.5 million dollars (Statistical files, ODMNA, Toronto) is produced from four large quarries in Trenton-Black River Limestone along the north shore of Lake Ontario.

The purpose of reexamining the quarry operations in 1971 was threefold. New quarries and extension of operations into deeper levels in existing quarries were described and sampled. Quarry sections in adjacent areas were correlated wherever possible and information was gathered on methods of operation and type and variety of products. This information forms part of a general review of the limestone industries of Ontario.

Devonian Limestone Resources of Southern Ontario: Devonian limestone resources in southwestern Ontario are of economic importance for production of aggregate, flux stone, lime, and cement. Aggregates are produced from the Bois Blanc Formation between Fort Erie and Hagersville and from the Detroit River Limestone farther west.

Production of raw material for the lime, metallurgical, and chemical industries is based on sections of pure limestone in the Detroit River Formation. Most important is a 100-foot section exposed in the Thames River valley at Beachville, northeast of Ingersoll. Three large quarries are operated here for the production of lime, flux stone for the steel mills in Hamilton, raw material for the production of cyanamid in Niagara Falls, and agricultural lime. Cement is produced from the same section at Zorra station.

The Detroit River Limestone dips to the southwest and reappears near Amherstburg. Here it is quarried for the production of soda-ash for which limestone and brines of the Salina Formation underneath are used. A large new quarry was opened late in 1970 replacing the depleted limestone resources of the old quarry site.

Production of stone from the Bois Blanc-Bertie and Detroit River-Dundee Formations in 1969 amounted to about 7-1/2 million tons. Production of lime, including production from Silurian limestones at Guelph and Hespeler, represented a value of about 12.5 million dollars in that year. Field work in 1971 consisted of recording and sampling newly opened ground. Existing quarries were reexamined as part of a general review of limestone resources in Ontario.

Clay Products Industry of Ontario: The clay products industry of Ontario was the subject of an extensive study by G.R. Guillet (1967). In his report, a total of 63 plants are described. In 1969, production of the heavy clay products industry in Ontario represented a value of $31,672,797, or an increase of 27 percent over production in 1967 (Statistical files, ODMNA, Toronto). The products concerned can be divided into the following categories: brick; drain tile; sewer pipe; structural tile; and expanded aggregate.

The geologic formations from which raw material for the heavy clay industry is obtained are: 1) clay deposits; 2) Hamilton Formation-Hamilton shales; 3) Queenston Formation-Queenston shales; 4) Georgian Bay Formation-Dundas shales.

A variety of products, primarily brick, is manufactured from the different shale deposits. Brick is produced in 16 plants in Ontario and only one of these, Superior Brick and Tile Company Limited at Rosslyn, 7 miles west of Thunder Bay, uses clay. Sewer pipe, flue linings, and structural tile are produced from shale or from clay imported from Pennsylvania or Ohio. Structural tile production is limited to three plants. Expanded aggregate or haydite is produced from Dundas shale in one operation.

The purpose of field work in 1971 was to make a survey of presently active production facilities and of the origin of raw materials being used. This information will serve to review Guillet's report (1967).

A total of 41 operations have been reexamined in this survey up to the present. Four plants were found to be destroyed by fire. Three plants were permanently dismantled whereas another three plants were idle and are not likely to be reactivated. There is a continuing trend towards concentration of increased production in fewer plants of modern design.

Special Projects:

Mineral Resource Surveys: Legislation introduced by the Minister of Mines and Northern Affairs, the Honourable L. Bernier and by his predecessor, the Honourable Allan F. Lawrence, concerning control of pit and quarry operations in the Niagara Escarpment area and elsewhere, has served to heighten a general interest in the aggregate producing industry. One result of this increased awareness is the concern of planning consultants and township councils to include pit and quarry operations in local land-use planning. In this context several requests for mineral resource surveys were received by the Department of Mines and Northern Affairs in 1971.

To satisfy requests for a mineral resource survey a brief report on the geology of a township is compiled. An evaluation of aggregate resource probability based on existing geological information is included. In some instances a survey in the field is necessary.

In 1971 the author was responsible for mineral resource surveys of Bruce, Huron, Malahide, Mountain, Winchester, Matilda, and Williamsburgh Townships. Field work was carried out in Bruce and Huron Townships.

Niagara Escarpment Task Force: As a member of the Niagara Escarpment Task Force the author participated in two field trips. Desirability of several development projects was evaluated in light of suggestions made by the Niagara Escarpment Study Group. Of particular concern is the Collingwood area, which is affected by a temporary freeze of all subdivision in Nottawasaga Township imposed by the Department of Municipal Affairs.

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No. 33 GEOCHEMICAL SURVEYS IN NORTHERN ONTARIO

by

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The detailed sampling of syenitic stocks in Cairo and Otto Townships completed in 1970 was expanded during 1971 to a reconnaissance examination of metal variability in and between widespread, well-defined bodies of felsic plutonic rocks that intrude Archean metavolcanic-metasedimentary belts in northern Ontario. Approximately 560 samples of bedrock were collected from 230 outcrop sites in eight separate felsic plutons listed in Table 1.

At each outcrop site two representative samples of unweathered rock chips weighing 2 to 3 pounds were collected about 20 to 50 feet apart. The paired system of duplicate sampling is similar to the method outlined by Garrett (1971) and is designed to determine local sampling variability for purposes of

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Table 1:

Plutons	Township(s)	Location District	Lat.N	Long.W	Associated Mineralization
Bear Lake (Syenite)	McVittie McGarry	Timiskaming	48°08'	79°39'	Au
Larder Lake (Syenite)	McVittie Hearst	Timiskaming	48°06'	79°42'	Au
McElroy (Granodiorite-Qtz.Monzonite)	McElroy	Timiskaming	48°05'	79°49'	--
Lebel (Syenite)	Lebel Boston	Timiskaming	48°07'	79°59'	Au
Coyle Lake (Granodiorite)	Elmhirst Walters	Thunder Bay	49°46'	87°43'	--
Kabenung Lake (Syenite-Monzonite)	Tp.32,R.26	Algoma	48°14'	85°04'	--
Setting Net Lake (Granodiorite-Qtz.Monzonite)		Kenora (Patricia Portion)	52°48'	93°35'	Mo,Cu
Dome (Granodiorite)	Dome Heyson Fairlie	Kenora (Patricia Portion)	51°02'	93°55'	Au

comparison with overall variability in each individual pluton. The project is designed to detect features of the primary syngenetic metal distribution and samples were therefore selected to provide representative coverage of the intrusions and to avoid contamination by younger vein and dike material. Samples from the eight intrusions are currently being analyzed for Cu, Pb, Zn, Mn, Mo, Hg, Li, Ba, Na, K, and Si by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs.

Geochemical and biogeochemical studies over mineralized and barren parts of the Setting Net Lake Stock were directed toward an examination of Mo and Cu dispersion in the surface environment. Samples of 'B' horizon soil were collected at intervals of 400 feet on a grid system covering the main zone of Mo mineralization. Samples of lower bark, second year twigs, and second year needles were collected from black spruce (Picea mariana) at 25 sites near known mineralization and in surrounding terrain covered by Pleistocene glacial-lake clays. Similar samples were collected from 5 control sites over the barren southern part of the intrusion. At selected sites, samples of lower bark and second year twigs were also collected from jack pine (Pinus banksiana), trembling aspen (Populus tremuloides), and white birch (Betula papyrifera) for purposes of comparing Mo and Cu responses in the various plant species. Samples of primary and oxidized ore were collected for mineralogical studies and pH and Eh measurements were made in streams, swamps, and soils near oxidizing sulphide mineralization. Samples of soil and plant materials are currently being analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, for Cu, Mo, Pb, Zn, and Mn.

During 1970, a program of surface soil sampling was started over the main ore zone of Mattabi Mines Limited at Sturgeon Lake. Most of the area covered by the 1970 survey was subsequently stripped of overburden prior to commencement of mining operations. In 1971, this soil survey was extended westward from the main pit site along the strike of felsic pyroclastic metavolcanics that host Cu-Zn-Ag ore. Core samples from two drill holes passing through the ore zone have been selected to show the widest range of mineralogical and chemical variability. These samples have been analyzed for Hg and a large number of other elements in an attempt to (1) examine the extent of mercury diffusion into the wall-rocks and (2) establish correlations between Hg and other elements as a means of determining which ore minerals are associated with mercury.

Experimental geochemical surveys in the vicinity of the Nemegosenda, Lackner Lake and Seabrooke Lake carbonatite complexes were designed to test the detectability of clastic dispersion in glacial drift over and "down-ice" from these niobium-bearing complexes. Boulders and cobbles of magnetite-apatite ore, ijolite, and nepheline syenite were mapped along a 6-mile traverse extending southwestward from the main ore zones at Lackner Lake. At regularly spaced intervals along this traverse, 30- to 40-inch deep pits were dug and samples of till and ice-contact drift were collected from the walls of these pits. Similar sampling procedures were followed in the collection of 74 till samples over the Seabrooke Lake complex and 26 samples of end moraine material southwest of the Nemegosenda complex. Samples weighing approximately 8 pounds are air dried and subjected to a sieve grain-size analysis. Heavy minerals will be separated from the -80 mesh +230 mesh size fraction and analyzed for Cu, Ni, Co, Mn, Zn, Ti, Nb, La, and Ce.

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